University of Alberta
Printing Department

THE UNIVERSITY OF ALBERTA

LONGITUDINAL PREDICTION OF GRADE NINE EXAMINATION SUCCESS FOR DIFFERENT URBAN SOCIO-ECONOMIC GROUPS

by

HARRY MOSYCHUK

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

DATE: FEBRUARY, 1965

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Longitudinal Prediction of Grade Nine Examination Success for Different Urban Socio-Economic Groups" submitted by Harry Mosychuk in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

The purpose of this longitudinal study was to determine which separate ability and achievement tests, or groups of these tests, given at Grades 3, 6, and 7 predict Grade 9 achievement most successfully for students from various socio-economic status levels.

Data from ability and achievement tests, written by students from the Edmonton Public School system in Grades 3, 6, and 7, and administered by classroom teachers under the general supervision of University of Alberta personnel, were selected for this study. The Grade 9 Departmental marks were obtained from the Alberta Department of Education. The data were used in the raw form or were T-scored, depending on the nature of the statistical tests carried out on them.

The samples for the study were selected from Elley's 271 Grade 7 boys and girls used in his 1961 study. In view of the availability of marks for the numerous variables two samples were established which were referred to as the Grade 3 Sample consisting of 207 cases, and the Grade 6-7 Sample of 237 cases. The two Samples were compared to an Edmonton 432 random sample on the basis of intelligence, occupation, and sex to determine representativeness. On the basis of the three variables, the two Samples were found to be representatives of the total Edmonton Public School population.

The procedure in the schools during the prediction interval was one where heterogeneously grouped students were promoted by grades. Two of the schools grouped students on the basis of

intelligence and achievement scores during certain years although no different or adaptive treatments were applied to these segregated classes.

The independent predictor variables in the study consisted of conventional and culture-reduced ability tests, achievement tests, and the Socio-Economic Score. These were studied in terms of their effectiveness in predicting Grade 9 Total, Science, Mathematics, Social Studies, and Literature-Language achievement for the total Samples as well as for the Upper, Middle, and Lower socio-economic Groups.

The following were the major findings for this study:

(1) The future achievement for the Lower socio-economic Group cannot be predicted accurately with any of the ability or achievement tests used in this study.

(2) In predicting Grade 9 Total achievement the addition of culture-reduced tests improved predictive ability more for the Upper and Middle Groups than for the Lower Group. The less culture-reduced tests contributed more for the Lower Group prediction than did the more culture-reduced tests.

(3) For two or three-year prediction intervals the conventional tests predicted Grade 9 Total, Social Studies, and Literature-Language achievement more accurately than did the culture-reduced tests for the total Sample as well as for the three socio-economic Groups. The culture-reduced tests tended to be superior for the Sample and for the Groups when predicting to less verbal criteria such as Grade 9 Mathematics and, to some extent, Grade 9 Science.

(4) Conventional tests at Grades 6 and 7 were better predictors of all Grade 9 achievement than the individual California Achievement tests. Culture-reduced tests showed better prediction for all socio-economic Groups when the criteria were of the less verbal nature such as Grade 9 Science and Mathematics. The California Achievement tests were superior to the culture-reduced ability tests for predicting to criteria such as Grade 9 Total, Social Studies, and Literature-Language achievement.

(5) In Grade 9 the achievement of the Lower Group was lower and that of the Upper Group was higher, relative to the whole Sample, than the achievement for the respective Groups in Grade 3 in more verbal areas such as Total school achievement and Literature-Language. The achievement for the two Groups during the six-year interval did not change significantly in arithmetic and mathematics.

(6) The Socio-Economic Scores, when added to the various independent variables in Grades 6 and 7, improved prediction of Grade 9 Total achievement. The S.E.S. increases prediction most when it is combined with the culture-reduced predictor tests.

ACKNOWLEDGMENTS

The writer is indebted to a number of persons who have made the progress and completion of this project possible. Foremost, thanks go to Dr. R. S. MacArthur who has contributed a very substantial amount of his time to provide constructive suggestions and counsel. The author is grateful to, Dr. R. S. MacArthur for initiating, and to Dr. W. B. Elley for carrying out the parent study, thus making available a major portion of the data for this undertaking.

Acknowledgments go to; Dr. W. B. Elley for his specific guidance in the early stages of this study; Dr. S. Hunka for his assistance in some of the analyses; T. McGuire in programing the data and supervising computations which were done on the 1620 Computer.

The writer likewise wishes to express thanks to his wife Esther Mosychuk for her varied assistance during the whole course of this study and to Mrs. D. Laverty for her careful and expeditious secretarial work.

Appreciation is expressed for the assistance offered by the Department of Educational Psychology for defraying computer costs.

The writer is sincerely indebted to all who have in any way contributed to the realization of this thesis.

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

TABLE PAGE

TABLE PAGE

CHAPTER I

THE GENERAL PROBLEM

The means of predicting the future accurately is something that man has been striving to attain through the ages. When the elements with which one is working are quite definable and a limited number of influences affect the final outcome, then the prediction can be fairly accurate. In the field of social sciences, however, the rules for prognosis are not absolute. Social scientists work with concepts which are difficult to define: intelligence, aptitude, personality, culture, and social status. They study people who not only bring different environmental backgrounds to the experiment, but who could be exposed to different treatment during the prediction interval. Because they work with human beings, at times it is not possible to set up ideal experimental situations. Nor can one control, or even know, all the influences that may affect the future event.

Prediction studies involve predictor and criterion measurements. These measurements may be made at the same time or they may be separated by a time interval, with the predictor measure obtained first. Whether the tasks to be measured for the predictor and the criterion are of the same nature depends on the particular prediction study in question. Usually the type of predictor used will be a function of: (a) the criterion, (b) the subjects used, (c) the length of the prediction interval, and (d) the treatment offered the subjects during the interval.

In this study both the criteria and the predictors involve measures of such constructs as intelligence, aptitude, and achievement. A discourse on the theories about these concepts is

necessary and will be presented. The criteria and the prediction intervals are not variable factors in this study. The treatment during the interval, which is another constant, is likewise described.

Of central interest in this study is the socio-economic status of the subjects involved. The socio-economic factor will be one of the independent variables in determining the types of tests to be used in obtaining predictor measurements. Research not only shows that frequently the same tests may measure different abilities and constructs in people of different socio-economic levels, but that different tests may have to be used with people from various cultures to obtain measures of the same ability. Therefore, although this study is one of prediction, theoretical considerations of the concepts measured, the instruments used, the people involved, as well as interrelations among some of these, will be presented.

The general purpose of this longitudinal study, then, is to determine which separate ability or achievement tests or groups of these tests given at Grades 3, 6, and 7, predict Grade 9 achievement most successfully for urban Edmonton students from various socio-economic levels. Implications of relationships between performance on some of these tests and socio-economic level scores will also be examined in this investigation. This study is another in a series of Edmonton surveys under the general supervision of the University of Alberta.

CHAPTER II

THEORETICAL FOUNDATIONS AND RELATED RESEARCH

Introduction

To make this study accurate and meaningful it is necessary to discuss fully the nature of intelligence. A survey of the general types of testing instruments available, as well as what they measure, is made. The methods of classifying people into various socio-economic status levels and the significant characteristics of the people from different levels is likewise reviewed.

Prediction studies, especially those involving measures of ability and of achievement for school children from varied environments and socio-economic backgrounds, are presented in this chapter.

The Concept of Intelligence

Various theories on the concept of intelligence beginning in the early part of the twentieth century ranged from the proposition that intelligence is a general unitary factor to those that expressed it is a multiplicity of specific factors. More recent psychologists put forth theses which included both ideas or which fell somewhere on a continuum between the two extreme views.

Of direct relevance was the early work of Binet (1916) in attempting to measure intelligence and present some interpretation of the concept. He tried to distinguish between "intelligence pure and intelligence simple", which probably corresponded to

what recent psychological theory refers to as Intelligence A and Intelligence B. Binet's observations, as well as Spearman's (1923), yielded intercorrelations among various measures of what were considered to be intellectual abilities. Spearman (Vernon, 1950) was particularly led to the idea of the presence of a unitary global factor in considering the concept of intelligence. Spearman's first interpretation of intelligence was that it consisted of this underlying general factor (g) and a number of specific abilities (s). The factor g was considered to be common to the performance of the majority of intellectual tasks while the s factors were specific to particular tasks involved and independent of g and all other s's. Spearman's theory, failing to provide for group factors which would fall between the g and the s's, received criticisms from some psychologists. However, in his more recent studies, Spearman (1950) described in detail the presence of such group factors. In summing up Spearman's contribution it appears that his g quantity especially had been favorably accepted by other psychologists. Thomson stated that, "... all abilities involve more or less g ...." (1951, p. 58). Burt (1959) in analyzing ability tests, claimed that this general factor was most useful for predicting efficiency in concrete tasks since, "... all types of intellectual achievement are correlated with it in varying degrees". Cattell (1943) likewise has accepted Spearman's g as one of the bases in the construction of his verbal and non-verbal ability tests.

Thurstone (Watson, 1961, p. 482), in his initial investigations, did not isolate any general factor but defined

intelligence in terms of eight Primary Mental Abilities which were: (1) verbal comprehension, (2) word fluency, (3) numerical ability, (4) spatial, (5) memory, (6) induction, (7) deduction, and (8) flexibility and speed of closure. He did, however, in his later work demonstrate a second order factor resulting from the overlap in his Primary Mental Ability group factors (Thurstone, 1947).

The Hierarchical Group Factor theory was put forth by Vernon (1960). He felt that the data presented in a problem solving situation could best be accounted for by the use of an hierarchical model. Varying amounts of different types of ability, from the general to the specific, were contributed to obtain a solution for the problem. Vernon placed a common general ability factor, similar to Spearman's g, at the top of his hierarchy. This factor accounted for the major portion of the variance found in a variety of cognitive tasks. Below the general factor he had the major group factors: the V:ed or verbal-educational and the k:m, the practical. Below these were the less general minor factors including abilities such as numerical, spatial, manual, and mechanical information. At the bottom of the hierarchy Vernon had numerous specific factors. Elley (1961, p. 44) suggested that such an arrangement would be a tentative and hypothetical one depending on the nature of the tests used and the population sampled. Vernon (1950, p. 26) himself suggested that this is,"... a hypothetical integration of all the factorial investigations that have been carried out".

A bold break with tradition was found in Guilford's (1959)

tentative three-way organization of intellectual performance. His model consisted of three orthogonal axes. One represented five types of mental Operations, the other four Content categories, and the third symbolized six Product areas. This yielded 120 different combinations each representing a type of task which, he says, may be presented in an intelligence test.

Hebb (1958) has described the concept of intelligence as Intelligence A and Intelligence B. Intelligence A is an unmeasurable inherited potential ability which, beginning at a person's birth, after interacting with the environment, will develop into a measurable Intelligence B. Hebb (1958) stated that, "... both these variables are of one hundred per cent importance: their relation is not additive but multiplicative". Vernon (1960), realizing that different tests will give a different estimate of Intelligence B, introduced a concept called Intelligence C, which is an estimate of Intelligence B and is obtained with a particular intelligence test. West (1962) stated that we also have Intelligence A' which is the present potential ability. If environmental conditions are ideal for optimal development of Hebb's Intelligence A, as observed in terms of Intelligence B, then Intelligence A' approaches the value of Intelligence A. This idea seemed to agree with Bayley's (1955) concept of intelligence which held that it is a dynamic succession of developing functions, with the more complex functions in the hierarchy depending on the prior maturing of earlier simpler ones.

Intelligence may, especially for the man on the street, be defined more adequately in terms of particular types of behavior. Wechsler (1958) pointed out that the noun "intelligence" is not a real observable or measurable entity and that its usefulness is derived from its ability to explain certain types of "... intelligent behavior". An intelligence test score is merely an expression of a person's intellectual, as well as some non-intellectual, functioning at that particular time and on that particular test. The concept of intelligence, said Ferguson (1954), is no longer a useful scientific concept as subsuming some defined set of distinguishable abilities. We may observe Elley's (1961) resumé of the definitions that leading people in the field have ascribed to the construct of intelligence. Some of them are: good judgment (Binet, 1916); abstract thinking (Terman, 1921); adaptation (Stern, 1914); learning ability (Freeman, 1940 -- reported 1955); and eduction of relations and correlates (Spearman, 1923).

Summary. While a majority of the early psychologists emphasized the unitary nature of intelligence, recent studies have stressed the multiple factor approach. A large number of workers in the field now, however, accept the g factor as well as group and specific factors. Some researchers state that intelligence should be described in terms of some referents such as intelligent behavior.

Development of Intelligence

The concept of intelligence should also be examined with reference to different stages of a person's growth. Hofstaetter (1954) claimed that at various age levels intelligence was a different entity. Up to 20 months the infant operates in terms of Factor I, which is sensori-motor alertness. From 20 months to four or five years Factor II or persistence operates, while from five years onward intelligence is Factor III, which is manipulation of symbols. Garrett's (1946) developmental theory stated that the dominance of Spearman's g in intellectual performance decreased and specific factors with increasing differentiation of abilities became more important with age.

Some theses regarding the development of intelligence were put forth by Hebb (McCandless, 1962) and Piaget (1950). They claimed that intellectual development had a definite sequence as well as a critical time, which is probably centered in the early years of childhood. Hebb, drawing his conclusions from experiments with animals, believed that in the first few months of a child's life a series of "cell assemblies" are laid down. He contended that if these assemblies are not laid at that time then the development of higher-perceptual-emotional functions may be slowed down or interfered with. Piaget maintained that the exploration of the early environment as well as sensori-motor associations during childhood formed the bases for many concepts used in later life to demonstrate intelligent behavior. Bayley (1957), from her work in the Berkley Growth Study, has postulated the possibility of,"... environmental 'critical stages'

for mental growth". The effects of early development on later behavior were suggested by Thompson (1954) as:

> There is no doubt that an individual continues to learn and perceive throughout his life span; but it is probable that he learns to learn and perceive quite early, and that once these basic capacities are fully developed they cannot be changed very much. It also seems true that there are certain periods in early life when a particular function or structure is maximally susceptible to change. It is probable that the length of these critical periods as well as their time of occurrence, varies considerably with different functions and structures. (Hoch and Zubin, 1954, p. 136)

Summary. The views regarding the development of intelligence during the childhood years will have some indirect significance in this study in view of the varied environments that pupils from different socio-economic backgrounds have had. It appears, in summary, that numerous psychologists agree that the concept of intelligence is not the same "thing" at all age levels and also that the early years are quite important in the development of what is referred to as intelligent behavior.

Nature - Nurture

The source of intelligence has been a contentious issue. Although most recent psychologists agree that the ability to behave intelligently is the result of inherited characteristics as well as environmental influences, there is still controversy as to the amount that each contributes, and how the two interact to produce the final result called intelligence. Burt (1955) took certain stands on the source of intelligence. He worked with twins, siblings, and unrelated children, each consisting of 318 cases, who were reared together and apart and compared

them on the basis of intelligence scores and scholastic ability. The fact that the correlations between intelligence scores for identical twins reared apart and together were 0.925 and 0.876 respectively, and for siblings 0.538 and 0.517 respectively, confirmed his theory that a large portion of intelligence was inherited. Scholastic ability score correlations of 0.814 and 0.526 respectively for siblings reared together and apart, suggested to him that environmental influences are likewise important in scholastic attainment. His studies led him to claim that 75 per cent of intelligence can be attributed to heredity and the remainder to the environment. In recent studies Burt (1959 b) goes so far as to say that 88 per cent of intelligence can be assigned to heredity.

Anastasi (1958) rejected some of Burt's heredity-environment theory because she believed that the influence of the two is not additive, as implied by Burt, but is multiplicative. This is in line with MacArthur's (1961) concept that intelligence is the result of innate predisposition and environmental influence interacting in a multiplicative rather than an additive manner. Hebb (1958) stated that there must be the innate potential ability at birth called Intelligence A as well as environmental influence to develop Intelligence A into a measurable or observable Intelligence B. West (1962), having agreed with MacArthur and Anastasi, set up a mathematical model of intelligence. He stated that .... B = AE where:

> B is Hebb's Intelligence B, present level of intellectual functioning, or that which intelligence tests measure.
> A is Hebb's Intelligence A or the innate substratum of predispositions or potentialities upon which potential behavior is developed.
> E is the totality of cultural or environmental experiences, which stimulate, thwart, and direct organized behavioral development. (West, 1962, p. 19)

It is evident that the measurable Intelligence B is a function of A and E and that A and E interact in a multiplicative manner. Both A and E are necessary and if one of them should happen to be zero there would theoretically be no Intelligence B. It must be remembered, however, that although numerically the product AE may be the same for various values of A and E the resulting B value may not represent the same type of intellectual functioning.

Ferguson (1954) believed that ability or intelligence of the type measured by common tests was really overlearning, which was brought about by the interaction of the environment with the individual's biological heritage. He mentioned that as the child grew older these abilities (the overlearning) must increase regularly to maintain satisfactory adjustment in a culture. If the culture is different, then different types of overlearning will occur or various abilities will develop.

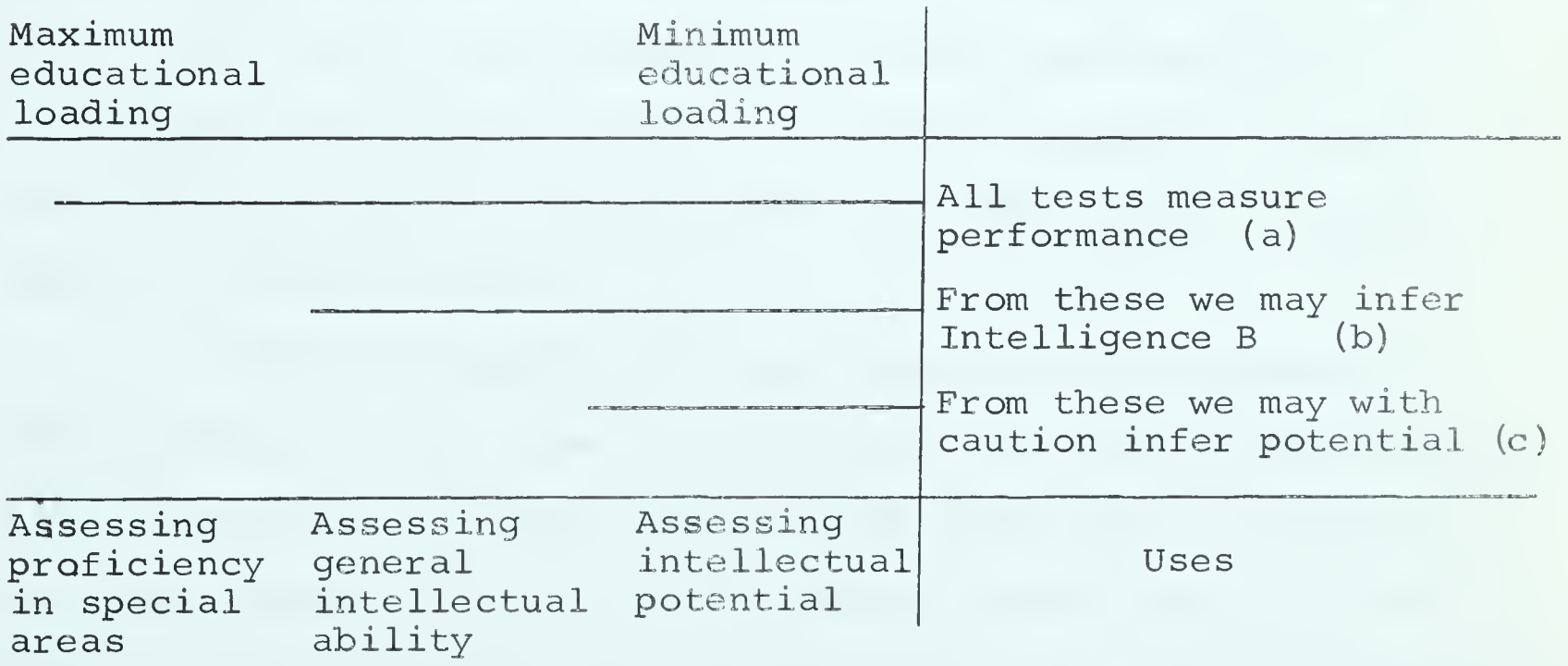
Summary. In terms of the research done in this area it would appear that agreement lies in the interpretation of intelligence or intelligent behavior, expressed as the result of a multiplicative interaction between certain inherited characteristics and one's environment.

Tests. Intelligence - Aptitude - Achievement

With little exception, tests, whether intelligence, aptitude, or achievement, basically measure performance. Aside from some neurological measures of intelligence, most tests really measure performance on certain tasks drawn from some portion of

the environment. Performance on these tasks will suggest to us how "intelligent" the person is or how well he learned and retained certain information. We infer from the test score certain characteristics or qualities that the testee may possess. Good (1954) stated that, "... we cannot measure ability directly; that we measure performance ... from which we infer ability, from which we infer capacity". West (1962) said that it would be psychometrically impossible, given that B = AE, to obtain a value for B from an intelligence test if E is disregarded or taken to be zero.

Different types of tests will enable us to infer different characteristics, in addition the type of test used will depend on the purpose of the test, as well as on the population that is tested. Cronbach (1960) set up a spectrum of tests ranging from those with minimum educational loading, which present tasks common to various cultures or educational environments, to the conventional verbal educationally loaded ones. Anastasi (1961, p. 486) analyzed ability measurements in the following manner:



It is apparent that Anastasi's interpretation of tests, as presented in the chart, is applicable for obtaining measures of a, b, or c for persons from varied backgrounds or different past environments. It can, of course, also be applied to a very homogeneous group in terms of socio-economic level or cultural background.

Tests which have tasks common to persons from varied environments could be used to compare, on the basis of some decided characteristic, all the members writing the test, whereas certain verbal educational tests with items from a particular culture would, in effect, bias those members who are from different cultures. The purpose of the measurement, or the nature of the characteristic to be measured, may determine what type of a test must be used. Educationally loaded tests are adaptable to measuring specific proficiency in special areas. As Anastasi (1961) pointed out, minimum educationally loaded tests are suitable for assessing intellectual potential of a more basic and general nature. However, we should note, as West (1962) said, that educationally loaded tests not only measure stored information but also thinking power or ability, provided that the educational tasks are common to the environments of all the testees.

A number of aspects of these tests must be considered with reference to the area of prediction. If standard conventional tests were used on members who have had different environmental influences then it is likely that those persons, from environments other than the one upon which the test was based, may be underrated.

If the members will not receive adaptive treatment during the prediction interval, and if the criterion is of the same nature as the original test, then this original test will serve as an accurate predictor for all members. Cronbach (1960) said that these maximally loaded educational tests are fairly well suited to fixed or non-adaptive treatment prediction of specific criteria such as academic school success, especially if the prediction interval is short. On the other hand, if in the interval, the members that were underrated were subjected to adaptive treatment of some sort they may perform much differently on the criterion measure than they did on the original predictor test. Consequently, the verbal educational loaded test may not be a good predictor for these members under these conditions.

It may, then, be useful to consider tests with tasks that are common to all social levels or cultures when making measurements in a heterogeneous socio-economic or cultural group. This type of a test would measure a general ability, similar to Spearman's g, which is less dependent on previous schooling and should, therefore, not overrate or underrate any of the members with respect to their potential. Now if any form of adaptive treatment occurs the performance on the criterion will be similar to that on the original test. The value of such a test in prediction lies in the fact that it measures a general ability which is stable and reasonably immune to particular environmental influences and to change. Elley (1961) summarized the value of g: "It is exemplified in the behavior of a more complex rather than simple kind, is relatively stable and independent of differences

or changes of environment, and is of considerable value in predicting to non-specific criteria". MacArthur (1961) likewise said that,"... general intellectual ability may be less influenced, than abilities lower in the hierarchy, by specific learning from the environment". It must still be kept in mind, though, that where students are subjected to what is referred to as non-adaptive treatment, and the criteria are verbal or similar to the predictor tests, then the culture-loaded verbal ability test may be an adequate predictor.

Culture-Reduced Intelligence Tests

Recently a considerable amount of work has been done by some psychologists in the field of culture-fair or culture-reduced intelligence tests. Tests such as Cattell's "Culture-Free" scale, the Davis-Eells Games, and the Raven's Progressive Matrices are representative of the minimum cultural loading tests. Cattell (1940), in his test, used a number of objects and processes common to various cultures. Attempts have been made by various researchers to evaluate the "Culture-Free" Scale. Marquart and Bailey (1955) showed that this test differentiated significantly less than the Stanford-Binet between social class at ages 8 to 15. However, Fowler (1955) was unable to detect such differences. Fowler also found no significant sex differences in a large urban sample on the Cattell Scale, while the Henmon-Nelson and the Detroit showed differences. Cattell (1958) himself found correlations of 0.6 to 0.7 with tests such as the Stanford-Binet and the Otis suggesting that a similar

concept was measured by the "Culture-Free" test. Studies by Drake (Buros, 1953) and Klineberg (1954), involving students from different tribes of India suggested large discrepancies between Cattell's norms and the Indian norms. It was assumed that the time limits on the test may have been one of the factors responsible for the difference. Cattell (1958) later suggested the abolition of time limits for cross-cultural studies.

Davis and Eells (1953), in the construction of their culture-fair test, attempted to keep previous experiences constant by selecting items from a number of socio-economic levels thus trying to make the test fair to members of all levels. Stillwell (Buros, 1959, reported by R. M. Drake) states that the test did not meet the claims of the constructors. This was argued when he discovered that the Games differentiated between social classes as much as the culture-loaded California Test of Mental Maturity. Burt (Buros, 1959) believed that it was not possible to evaluate the test in terms of face validity because the constructors' definition of 'problem solving capacity' was too vague. Elley (1961) stated that, on the basis of the various evaluation studies performed on the Davis-Eells Games, conclusions can be reached suggesting,"... that the authors' purpose has not been achieved". From research on these tests,Elley (1961) claimed that Cattell's method of holding past learning to a minimum is more promising than Davis' and Eells' attempt to hold it constant.

There may be implications which suggest that certain intelligence tests may be culture-free or that the objective of

test construction should be the development of a standard type of a test, free of cultural influences. However, keeping in mind the various theories to date on the nature of intelligence or intelligent behavior, it appears that the standard test could be culture-reduced but not culture-free.

General characteristics of culture-reduced tests have been discussed. Elley (1961, p. 186) presented a set of specific workable criteria for assessing whether a test falls in this category. They were:

(a) high g loading
(b) low correlation with socio-economic status
(c) absence of group environmental factors
(d) lack of dependence on acquired information
(e) medium correlation with school achievement
(f) regular pattern of item discrimination across the socio-economic levels.

He claimed that the Raven's Progressive Matrices seemed to satisfy these criteria best.

Summary. (1) A test score is a measure of performance on tasks sampled out of a universe of tasks in some environment.
(2) The tasks in a test may be common to a particular environment or to many cultures and environments.
(3) Tests range in structure from culturally loaded, verbal educational tests to culture-reduced tests with minimum educational loading.
(4) Test uses range from the measuring of proficiency in specific academic areas to estimating intellectual potential.
(5) The Raven's Progressive Matrices appears to be a promising culture-reduced test.

Sources of Differences in Performance on Intelligence Tests

Measurement would be more amenable for comparisons and contrasts if all persons tested were from the same socio-economic level or culture. One of the major problems in cross-cultural measurements is the significance of test score differences. Binet (1916) was probably the first to make any systematic observations and attach some importance to differences in intelligence test scores among different socio-economic classes. He believed that these differences were due to the effects of heredity and environment. Stern (Eells, 1951) in 1914, and Burt (1922) were also pioneers in studying socio-economic differences in test performance. Neff (1938), Loevinger (1940), Herrick (Eells, 1951), and Anastasi (1958) in various studies have indicated that persons of high socio-economic level, score up to 15 to 25 IQ points higher on conventional verbal tests than persons of low socio-economic levels. Elley (1961) found that occupational status is one of the significant variables in intelligence test scores.

Most of our conventional intelligence tests commonly consist of tasks sampled from a particular culture or environment. Where all subjects have been influenced by more or less the same environment, the measured scores may reveal differences in terms of ability rather than familiarity of tasks. According to Ferguson (Dingman, 1958), too often performance at a particular level on an intelligence test is taken to indicate ability when in fact it may, to a large extent, indicate familiarity. Haggard (1954) stated that factors such as motivation, interest,

and familiarity with testing procedures are some of the main causes for differences in performance by people from various socio-economic levels. People confronted with foreign situations, such as tests which are not common to all societies, may become anxious and uncertain and perform at a level which is below their "true" ability. Differences in the number of learning experiences produce real differences in ability, if we interpret ability in terms of Ferguson's overlearning theory. Vernon (1958) stated that the extent of the use of intellectual powers in the early years has considerable bearing on their performance in later years. Halsey (1958) likewise contended, that the background environment has a large effect on test performance. He said, "... that observed differences in measured intelligence are more likely to be explained by environmental rather than by genetic factors.... It is possible that class differences may be entirely environmental". In working with underprivileged children, Skeels and Fillmore (1937) noted progressive deterioration with age in relative ability in children from the lowest socio-economic level.

Burt (1959) found a correlation of about 0.32 between socio-economic level and intelligence scores. He claimed that 50 to 75 per cent of this is due to inherited differences brought about by assortative mating through a number of generations. Burt also said that the more capable, as well as ambitious, people "get ahead" and usually reach a higher socio-economic status level.

Performance on tests by people from different cultures

may also differ because of test bias. Eells (1951) has produced evidence to suggest that bias in most intelligence tests exists and tends to favor the upper middle class children. He discovered that all test items which showed unusually larger scores for high socio-economic level groups than for the low groups, were of the verbal symbolism type. The subject matter of items that did not show significant status differences were either completely non-cultural or were drawn from experiences of children of all status levels. With respect to intelligence test scores Eells consequently states that test users should be cautious in interpreting test results for low socio-economic level children. Elley and MacArthur (1962), in a parent study to this investigation, found that socio-economic status correlated less with the Raven's Progressive Matrices score than it did with more verbal tests. This suggests that a culture-reduced test such as the Matrices, will differentiate less among the various socio-economic levels and bias less against any particular groups. Havighurst and Janke (1944) gave verbal and non-verbal intelligence tests and tests of reading, space, mazes, and mechanical assembly to all 10 and 16 year olds in a small city. The members were divided into five socio-economic classes. Significant differences in scores were found for most of the tests, the exceptions being the mechanical assembly and the spatial.

In summary we can present West's (1962, p. 12) conclusions from Elley's 1961 study which contends that there are three main variables which may account for variance in measures of

Intelligence B among children from different socio-economic classes:

(a) hereditary differences
(b) differences in opportunity to develop intelligence
(c) cultural bias of the test
    (i) item dependency on information or skills that not all children have had equal opportunity to acquire
    (ii) dependence upon acquired personality factors more likely to be developed in one culture than another, e.g. motivation, work habits.

Prediction

Various procedures will be used in this study to establish some valid predictors as well as some other findings. To this end a number of studies related to the following topics will be described: differences in predictive validity for the two sexes; the influence of the socio-economic status score in the predictive validity of various tests; the effect that environment has on the performance of children from various socio-economic levels at different stages in their development; and the selection of appropriate tests to predict future achievement for people of different socio-economic status levels.

Sex Differences. Evidence for sex differences in the predictive validity of certain tests is somewhat inconclusive. Jacobs (1959), working over a three-year period in certain Cincinnati high schools, found that the criterion behavior of girls in some specific cases were significantly more predictable than that for boys. He attributed some of this difference to a reduction in range of ability for the boys, since there were more drop-outs for that sex. Scannell (1960) found that, for Iowa high school and college freshmen students, in most cases, the girls'

performance could be predicted with more accuracy, although, in one case the correlation coefficient was higher for boys than for girls. Some studies were conducted to examine the magnitude and direction of any differences in performance at particular stages during the schooling process. It was felt such differences would influence predictive validities. Bryan (1957) said that these performance differences would really be qualitative rather than quantitative, although they would show up quantitatively as a particular test score. He stated that these qualitative differences were the result of different interests by the two sexes and, since interests change through the years, so might test score differences change for the different sexes. Bryan did not, however, discover any definite trend in test performance for either sex. While working with an Edmonton sample, the majority of the cases being the same as the ones used in this study, Elley (1961) obtained correlation coefficients for intelligence and achievement test scores over the interval from Grade 3 to Grades 6 and 7 for the two sexes. He found few significant differences between the two sexes for predicting Grades 6 and 7 performance using Grade 3 predictors.

Prediction of Achievement. Most of the studies involving the prediction of achievement, using ability and achievement tests as predictors for people of mixed socio-economic levels, have been done for the high school or early college level. However, Cooper (1958) did a study using 164 Grade 5 bilingual Guam pupils and found zero order correlations between various ability

test scores as predictors and an achievement score as a criterion. The achievement test was the California Achievement Form AA Elementary Level. The correlations found were: Davis-Eells Games 0.53; I.P.A.T. Cattell Test of g-"Culture-Free" 0.55; California Test of Mental Maturity 0.64; Columbia Mental Maturity Scale 0.55; Leiter International Performance Scale 0.66; and the Wechsler Intelligence Scale for Children (WISC) 0.77. The verbal and educational nature of the California Achievement Test criterion, no doubt, explains the higher coefficients for the educationally loaded intelligence tests and the lower ones for the Davis-Eells Games and the I.P.A.T. "Culture-Free" Scale.

A study using intelligence, aptitude, and achievement measures to predict high school academic success was performed by Jacobs (1959). He used a carefully selected sample of Cincinnati high school students over a period of three years. It was found that an intelligence test combined with an arithmetic proficiency test predicted high school achievement most accurately. Altus (1956) investigated the validity of the Davis-Eells Games as a predictor by correlating the test with the California Test of Mental Maturity and the California Achievement Tests of Reading and Arithmetic. The tests were administered to the fourth grade classes from four schools in a Midwestern town. The sample consisted of 93 boys and 91 girls. For certain parts of the study the whole sample was divided into monolinguals and bilinguals. In one phase of his investigation Altus studied the intercorrelations between the achievement tests and the two intelligence tests. He also noted the differences in IQ values

for the two intelligence tests. Table I suggests that the CTMM Total would be a better predictor of achievement than the D-E

TABLE I

PEARSON CORRELATIONS BETWEEN MEASURES OF APTITUDE AND ACHIEVEMENT*

Achievement Test Grade Placement	D-E Raw Score	CTMM Total	CTMM Lang.	CTMM Non-Lang.
California Reading	0.48	0.79	0.77	0.49
California Arithmetic	0.43	0.67	0.58	0.52

* From Altus (1956, p. 230)

Games. Even the CTMM Non-Language seems to be more related, though not significantly, to achievement than the D-E Games. For the bilingual sample, the mean IQ scores on the D-E Games, the CTMM Language and the CTMM non-Language were 97.7, 86.7, and 93.8 respectively. The difference between the mean scores for the D-E Games and the CTMM Language was significant at the 0.01 level. It was also found that more bilinguals had high D-E Games scores than CTMM Total scores. The magnitudes of the mean scores in Table II could suggest that the D-E Games score is somewhat more realistic than the CTMM Language score of 86.7. Being a more realistic measure, it may serve as a better predictor. In relating some of these studies to the present investigation it must be remembered that for most of the studies the time interval between the predictor and criterion was short. In some

TABLE II

TEST RESULTS FOR THE BILINGUAL SAMPLE*

Test	Mean	S.D.
D-E Games	97.7	15.4
CTMM Language	86.7	14.3
CTMM Non-Language	93.8	24.9
California Reading (Grade)	3.7	1.3
California Arithmetic (Grade)	3.7	0.8

* From Altus (1956, p. 231)

cases the two were administered at the same time. With this in mind, however, the evidence showed that, for predicting performance on academic or educational tasks, the verbal educationally loaded tests were the most valid predictors. The culture-reduced tests showed value in some bilingual measurements.

Influence of Socio-Economic Status Scores on Prediction Validity. Some relationships between socio-economic scores and ability test scores, with implications for prediction, were shown by Elley (1961). He found that correlations between socio-economic scores and culture-reduced test scores were lower than for culture-loaded test scores. Knief's and Stroud's (1959) results in this area were in agreement with Elley's results. They used the Lorge-Thorndike (L-T) Verbal and Non-Verbal, the Davis-Eells Games, the Raven's Progressive Matrices (RPM), the Iowa Test of Basic Skills (ITBS), and Warner's Index of Status Characteristics (ISC) to obtain their findings. Three hundred forty-four Grade 4 Midwestern boys and girls were given all the above tests except

the RPM. The Matrices was given to 164 of these in their fifth grade year. The ISC score was included with the D-E Games plus the L-T Non-Verbal as well as with the L-T Verbal to assess the multiple correlation coefficient with the ITBS. The correlation coefficients were significantly larger when the ISC was used than when the ability tests were correlated without the ISC score. This suggested that a socio-economic score when added to certain predictors increased the predictive validity. Also, when the ISC score was included with the D-E Games and the L-T Non-Verbal to correlate with the ITBS, the multiple R coefficient was increased more than the zero order coefficient was increased when the ISC was added to the L-T Verbal to correlate with the ITBS. The socio-economic score seemed to be a culture loading, which acted as a culture-loaded test, to predict achievement in a particular culture. The effect of this loading is greatest on the culture-reduced tests since these tests are correlated less with socio-economic level and with achievement test scores.

Socio-Economic Classification

The problem of socio-economic stratification is germane to this study since the population consists of people with different language backgrounds, as well as people from different socio-economic levels. For years sociologists have been attempting to set up a workable basis for the classification of people. The question of whether the criteria for classification are objective or subjective has been one of prime concern. Centers (1949) said that:

> Stratification is something objective; it derives, as has been indicated before, primarily from the economic

> system. ...The process of earning a living imposes upon people certain functions, statuses, and roles. ...Social and economic groupings and categories of people distinguished on the basis of occupation, power, income, standard of living, education, function, intelligence or other criteria are easily and properly denoted by the terms stratum or strata. ...But these strata, as some have seen, are not necessarily classes.
>
> Classes are psychosocial groupings, something that is essentially subjective in character, dependent upon the class consciousness (i.e., a feeling of group membership), and class lines of cleavage may or may not conform to what seems to scientists to be logical lines of cleavage in the objective or stratification sense. (Super, 1957, p. 21.)

Moore (1947) further quoted a definition from a text by Sutherland and Woodward (1948 - 3rd ed.) "Classes are inclusive loosely organized groupings whose members behave toward each other as social equals and towards outsiders as social superiors or inferiors...." (Super, 1957, p. 21). In recent years, it has been generally agreed that a combination of factors such as attitudes, activities, occupation, and material wealth establish ones socio-economic status level. Barber (1957) stated that socio-economic classification should be based on: (a) how people evaluate one another, (b) how people associate with one another, and (c) the material possessions and symbolic activities people display (includes occupation).

Most earlier researchers in this field, however, concentrated on particular variables. Edwards (1943), for example, emphasized occupational classification as a basis and introduced six categories ranging from Professionals to Unskilled Labour. He called this the Economic Scale of Occupations. A socio-economic classification scale suitable for Canada was developed by Blishen (1958). Using national census data he selected 343

occupations and determined their mean income and the average number of years of schooling. The two scores were standardized and combined with equal weighting to form the Canadian Occupational Scale. It was found that this scale correlated 0.94 with Hatt's (1953) "National Opinions Research Centre Index" which was based on how people classify each other in terms of their opinion.

Warner (1949) and associates developed a socio-economic classification scale that emphasized four criteria: occupation, home, neighborhood, and source of income. The scale was developed from the four weighted items into the Index of Status Characteristics (ISC).

Gough (1949) on the other hand felt that occupation or material wealth was only one aspect of socio-economic status or social prestige. He introduced a Home Index Scale using the questionnaire approach. The Scale consisted of 21 yes-no items which asked questions such as: Is there a writing desk in your house? or Does your family get a daily newspaper? A re-test reliability coefficient of 0.989 was obtained for college students and a Kuder-Richardson coefficient of 0.74 was obtained for high school students. In terms of readability Flesch (1948) claimed that the scale was within the average junior high school child's range. The Home Index Scale, it was found, correlated 0.65 with the Blishen Scale.

Summary. Most socio-economic status classifications use the occupation-variable as one of the criteria. Other significant

variables are the home (facilities, size, value), neighborhood, as well as some subjective criteria such as other people's opinions of where one falls in the socio-economic status level. Of importance is the high correlation between Blishen's fairly objective classification and Hatt's subjective opinion scale.

CHAPTER III

DEFINITIONS, POSTULATES, and HYPOTHESES

Definitions

1. Intelligence (ability) - present level of cognitive performance, usually measured with an intelligence test, acquired through an interaction between an inherited quality and one's environment. Hebb's Intelligence B is this type of ability.
2. Intelligence A - characteristic or potentiality inherited at birth upon which intelligent behavior is developed.
3. Intelligence A' - a present potential ability to develop future intelligent behavior. It can never be larger than Intelligence A; however, successful previous interaction with the environment will cause Intelligence A' to approach the value of Intelligence A.
4. Culture-reduced intelligence tests - tests where cultural biases in the tasks are reduced to a minimum. They may strive to offer tasks of equal familiarity to people from different cultures or present tasks which are less influenced or determined by a particular environment.
5. Conventional verbal intelligence tests - tests which have tasks common to our educational environment and usually require verbal facility for understanding instructions, comprehension of questions, and for making responses.
6. Culture loading (in a test) - saturating an instrument with items which would be common to a particular culture or environment.

7. Educational loading (in a test) - saturating a test with tasks which are closely related to formal or informal previous school learning situations.
8. Socio-Economic Score - a score designating the socio-economic status level of a person. The Score is composed, with equal weighting, from two scores; the Blishen Occupational Scale and a modified Gough's Home Index.
9. Adaptive treatment - a procedure typically used in school whereby special consideration or treatment is given to people from socio-economic groups or environments which are different from the social level upon which the school standards are based. This procedure, it is argued, can best be used when the potential intellectual ability of these people is higher than that shown by conventional culturally loaded tests. The procedure provides appropriate treatment for the right students thus enabling them to bring their intellectual behavior, for their particular ability level, in line with the school's educational standards.
10. Fixed treatment - "... treatment for the students which is fixed 'a priori' without regard to information from the particular persons involved" (Cronbach and Gleser, 1957, p. 26). In the context of this study such treatment, because it would be imposed upon pupils from different socio-economic levels, would probably not be suitable for the maximum development of all the pupils.
11. Predictive validity - directly related to the accuracy with which a measurement or a number of measurements will enable

one to estimate some other criterial performance. This performance would be at some time subsequent to the original measurement or measurements.

Since West's (1962) and especially Elley's (1961) studies have direct bearing on this investigation the reader will notice that many of the above definitions are adaptations of the working definitions from these two studies.

Postulates

1. People from different socio-economic classes have different values because they have been exposed to different environments. In addition they will probably have varied language backgrounds, different exposure to books and verbal influences, varying amounts of money, different motives, as well as different attitudes towards work, education, and religion. These factors would undoubtedly influence performance on tests.
2. People from the high and middle socio-economic classes generally have more ambition and are more interested in "getting ahead" than lower class people. Conversely, more intelligent people are more likely to be successful and as a result move into a higher socio-economic class. Such characteristics may account for some of the differences in performance on tests among persons of different socio-economic status.
3. Different people from various socio-economic levels who may be potentially just as capable, according to some defined criterion, may perform very differently on conventional

verbal or educational tests because of differences in familiarity of items and test writing procedures.

4. Culture-reduced intelligence tests, because they use tasks which are sampled from a universe of tasks found in more than one culture or environment, would measure more accurately than conventional verbal intelligence tests, that ability which is more lasting and less influenced by education but which may be basic to educational progress. If the school was to a sufficient extent adaptive, the students would work at the level indicated by the culture-reduced tests and would, in the future, achieve on specific educational tasks at about the same level as they did on the culture-reduced tests. This should result despite the different backgrounds possessed by the students.

5. Verbal educational tests show how a person "fits" into the setting or environment upon which the test is based. If the educational process remains the same in future years with no adaptive treatment for students from differing environments, then these tests will predict accurately the future performance for persons from any socio-economic level.

6. If the predictors that are employed use specific tasks which are common to the environment within which the criteria are found, then these predictors, especially over short periods of time, will predict to the criterion better than predictors using more general tasks and measuring more general abilities.

Hypotheses

This longitudinal study is primarily designed to investigate and identify valid predictors of future achievement for junior high school students from various socio-economic levels in an educational setting similar to the one now operating in Edmonton. It was hypothesized that the predictive validity, especially for the lower socio-economic children, could be improved by the introduction of culture-reduced intelligence tests particularly if there is some form of adaptive treatment. Prior to analysis of data the intelligence tests were inspected and categorized into two groups, the culture-reduced and the culture-loaded or conventional.

Category I Culture-Reduced Tests	Category II Conventional Culture-Loaded Tests
1. California Test of Mental Maturity S-F Primary S-F Elementary } Non-Language Scores	1. California Test of Mental Maturity S-F Primary S-F Elementary } Language Scores
2. Raven's Progressive Matrices Coloured Standard	2. Laycock Mental Ability Test
3. I.P.A.T. Cattell Test of g "Culture-Free" Scale	
4. Lorge-Thorndike Non-Verbal Intelligence Test Level 4	

In this study culture-reduced tests will be the ones listed in Category I. All other intelligence tests will be of the Category II nature.

The following hypotheses were set up to research the major

problem mentioned in the previous paragraph as well as some minor ones relevant to the general investigation:

Hypothesis 1. Over and above the prediction based on conventional culturally loaded ability tests, culture-reduced ability tests given at Grades 3, 6, and 7 contribute more to the predictive validity for the Lower socio-economic Group than for the Upper Group in predicting Grade 9 Total achievement. Hypothesis 1 represents the core of this study.

Hypothesis 2. (a) In predicting Grade 9 achievement, verbal ability tests at Grades 6 and 7 will have higher predictive validity for the whole Sample than will culture-reduced ability tests at Grades 6 and 7.

(b) In predicting Grade 9 achievement, achievement tests at Grades 6 and 7 will have higher predictive validity for the whole Sample than will intelligence tests at Grades 6 and 7.

Hypothesis 3. The achievement test scores for the Lower socio-economic Group will be lower and for the Upper Group will be higher, relative to the whole Sample, at Grade 9 than the achievement scores for these respective Groups at Grade 3.

Hypothesis 4. The validity of ability and achievement tests at Grades 6 and 7 in predicting Grade 9 achievement, for the two whole Samples, increases when the ability and achievement test scores are combined with the Socio-Economic Scores.

CHAPTER IV

EXPERIMENTAL DESIGN AND PROCEDURE

Description of the Area Being Investigated

All the students who were tested for this study were from the Edmonton Public School system. Edmonton is an urban community whose population in 1962 was about 330,000. Although situated in a mixed farming area, the oil industry in the last 15 years has probably added more to the growth of the city than the surrounding rural districts. The population is quite heterogeneous with respect to socio-economic status. With the exception of the Upper-Upper class, all the categories of Warner's (1949) six levels are quite appropriately represented. In terms of occupations, Elley (1961) found that all occupations on the Blishen Scale, except rural workers and farmers, were represented in his sample.

The Edmonton population cannot be considered to be representative of the Alberta or the Canadian populations. Anastasi (1958), as well as other researchers, have shown discrepancies between urban and rural children in terms of mental ability scores. Reid and Conquest (1955) have shown that the situation in Alberta is quite similar. Differences in terms of representation in the various occupations and socio-economic levels are evident between urban and rural populations. However, it would be safe to assume that the Edmonton population would be quite representative of other Canadian cities of similar size and composition. It may, therefore, be reasonable to generalize findings from this study to other such cities if the Samples in

this study are representative of the Edmonton population.

Data Available From Previous Studies

Data used for this study have been obtained from a number of sources dating back to 1956. In May, 1956, under the Edmonton Public School Board's Grade 3 Survey more than 3,500 Grade 3 children were given a number of tests. Data from the California Short Form Test of Mental Maturity (Primary 1953), the Raven's Coloured Progressive Matrices (1947), and the California Achievement Battery (Primary 1951) will be used for this investigation. The tests were given by classroom teachers and scored by university research students.

In May of 1959, under the Edmonton Grade 6 Survey, these same students were again tested with appropriate batteries. The administration and scoring of the tests was similar in procedure to the 1956 program. Data from the California Short Form Test of Mental Maturity (Elementary, 1957) and the California Achievement Battery (Junior High, 1957) will be used in this study. At this time the Laycock Mental Ability Test scores were also obtained.

The following year, a sample of 432 students was chosen from three schools which would be representative of Edmonton, especially in terms of socio-economic level. This was done by W. B. Elley under the supervision of Dr. R. S. MacArthur of the University of Alberta. Three schools, one from the southwest, one from the southeast, and one from the north area of Edmonton were selected contributing 89, 158, and 185 students, respectively. The school from the southwest, an Elementary-Junior High school,

represented a larger portion of higher socio-economic children; the one from the southeast likewise an Elementary-Junior High contributed the major portion of the middle socio-economic class; while the one from the north area, a Junior High school, supplied a larger portion of lower class sample. Elley claimed that the three schools differed considerably in location, size, administration, as well as in tested ability level and socio-economic characteristics of their members. After careful consideration a sample of 271 was selected from the 432. Elley (1961) compared this sample in terms of age, IQ score, occupation level, and sex to a random sample of 432 students which were drawn from the Edmonton 1959 Grade 6 Survey. Since no significant differences were obtained it was safe to say that the 271 sample was representative of the Edmonton population. The tests in the seventh grade in May, 1960, were again given by classroom teachers. However, Elley carefully supervised the administrative procedures. Information from the California Short Form Test of Mental Maturity (Elementary 1957), Raven's Standard Progressive Matrices, I.P.A.T. Cattell Test of g "Culture-Free" Scale 2, Lorge-Thorndike Intelligence Test Level 4, the Home Index questionnaire, and the Blishen Occupational Scale will be used by the present writer and, only data from tests given in 1956, 1959, and 1960 listed above, will be used.

The Sample

In 1962 the writer obtained the Grade 9 Alberta Department of Education Examination scores for as many of the 271 cases from the original Elley Grade 7 sample as were available. Because

of occasional missing marks for some of the variables from Grade 3 through to Grade 9 and because it was advisable to keep the number of cases as large as possible while keeping the same cases for all variables, it was necessary to select two samples, one for Grade 3 variables and one for Grade 6-7 variables to interact with the Grade 9 variables. These two samples called the Grade 3 Sample and the Grade 6-7 Sample consisting of 207 and 237 cases, respectively, are all part of Elley's 271 Grade 7 sample. The two Samples, with the exception of 46 members, contain identical cases. These samples were compared with the random Edmonton Grade 6 sample of 432 cases on the basis of intelligence scores, occupational level, and sex to see if they were representative of the Edmonton population.

The Grade 3 and Grade 6-7 Samples were both divided on the basis of the Socio-Economic Score into three equal socio-economic groups; the Upper, Middle, and Lower Groups. The Grade 3 Groups contain 69 each while the Grade 6-7 Groups had 79 cases each. Different sections of this study require the use of the Samples as wholes or as individual socio-economic Groups.

With as much accuracy as possible, the writer investigated the procedure in the schools during the prediction interval. It was found that the present treatment, that is the treatment during the prediction interval, consists of a grade system of promotion with heterogeneous classes. Some of the schools, during certain years, segregated the students into classes on the basis of intelligence and achievement scores. However, no different

treatments were offered these different classes. In terms of the definition in Chapter III, this treatment could be considered somewhat non-adaptive.

Description of the Tests Used

In view of the availability of data for quite a number of tests from previous studies it was necessary to decide which variables should be used in this study. After careful consideration of the aims of the study as well as the characteristics of the tests, a group of instruments was selected which would represent two general types of intelligence tests; the culture-reduced and the conventional culture-loaded. Some of the achievement tests were also chosen. In the selection of these tests factors such as practical utility in terms of administration and economy for future application by school systems were also considered.

A. The Grade 3 Battery

1. California Test of Mental Maturity - Short Form, Primary 1953. This was one of the tests given to all Grade 3's in the Edmonton Public School system in 1956. The test consists of seven sub-tests which measure four factors: Spatial Relations, Logical Reasoning, Numerical Reasoning, and Verbal Concepts. Criticisms have been leveled against the test by some psychologists (Buros, 1959) who claimed that these four factors have been developed from logical rather than factorial constructs. In addition to the factor scores, the test also yields a Language and a Non-Language score. Although the test as a whole is a good example of a culture-loaded

instrument, it is hoped that the Non-Language section might operate as a culture-reduced device, for Eells (1951, p. 388) stated that the Non-Language section is as culture "free" as other reputed culture-reduced tests.

According to the manual, the test designers, after considerable research, concluded that this test measures constructs quite similar to those that the Stanford-Binet measures. In a study by Sheldon and Manolakes (1954), on 422 pupils ranging from five years 10 months to 12 years 11 months, a correlation coefficient of 0.70 was obtained between the IQ scores for the CTMM S-Form and the Stanford-Binet. Altus (1952) stated that for a representative sample of junior high students the correlation between IQ scores from the CTMM S-Form and the Wechsler Intelligence Scale for Children was 0.81. Many studies showed that the CTMM S-Form correlated as well with reputable individual intelligence tests as it does with other group intelligence tests.

The reliabilities for the test as indicated in the manual are: Language 0.72-0.88, Non-Language 0.82-0.90, and Total 0.87-0.92. These have been calculated by the split-halves method and corrected by the Spearman-Brown Formula.

The test requires about an hour to administer and has special score sheets for ease of marking.

2. Raven's Coloured Progressive Matrices (1947). This scale, according to Raven (1960), is "... designed to assess as accurately as possible a person's present clarity of observations and level of intellectual development...." This

particular scale is to be used with children up to the age of eleven years. Research, describing and testifying the usefulness or validity of the Progressive Matrices as a culture-reduced test, is presented on page 45 in the description of the more used Standard Progressive Matrices test.

The coloured version of the test consists of three sets A, A_B, and B of 12 matrices each. Each item in Sets A and B consists of a matrix or pattern of four figures one of which is missing. The examinee must select one figure from the six set out below the matrix which would complete the pattern. The items get progressively more difficult. Set A_B was introduced to provide greater discrimination for young children. According to the manual, the test is not timed.

Re-test reliability coefficients, reported by Burke (1958), for nine-year-olds were in the order of 0.80. In a study of a group of one hundred Grade 3 students, Martin and Weichers (1954) obtained a correlation coefficient of 0.91 between the Raven's Coloured Progressive Matrices and the WISC thus suggesting that the Matrices may be measuring constructs similar to those measured by the WISC.

3. California Achievement Battery - Primary (1951). The test consists of three general achievement areas: Reading, Arithmetic, and Language. Each section provides three scores: Reading yields Comprehension, Vocabulary, and Total scores; Arithmetic provides Reasoning, Fundamentals, and Total scores; and Language gives Mechanical, Spelling, and Total scores. There is also a Total test score available. This study will only use the Total test scores. The test items are clearly

stated and the test has good format.

The Kuder-Richardson reliability coefficients range from 0.83 to 0.95. Neidt (Buros, 1959) claimed that the fairly high correlation coefficient with other achievement tests suggested adequate validity. Neidt also found that the reporting by the test authors regarding empirical evidence on the construction of the tests was very thorough. According to Schindler (Buros, 1953), the California Achievement Battery was more useful than other achievement tests because it: (a) covered the full range of achievement, and (b) was accompanied by the CTMM which allowed comparisons to be made between ability and achievement scores for the same norming group.

B. <u>The Grade 6 Battery</u>

1. The California Test of Mental Maturity - Short Form Elementary (1957). This test has the same seven sub-tests and four factors, the same scores and is reported to measure the same constructs as the Primary level does. Elley (1961), however, reported that this test depends more on reading skills than does the Primary level. The test was likewise designed on the basis of logical concepts of intelligence rather than statistical analysis. This test will, just as the Primary level, be used for their Language and Non-Language scores. Strang (1943) and Nolan (1942) have testified to the value of the Language and Non-Language scores for purposes of educational diagnosis and guidance.

In addition to the studies cited on page 40 in the Grade 3 battery, Clark (1949) likewise supported the validity of this

test. He found that the CTMM Advanced IQ scores correlated at 0.81 with those of the Wechsler-Bellevue. West (1962), in summarizing various studies, found that the attenuated validity coefficients for the Language section ranged from 0.8 to 0.9 and for the Non-Language section from 0.6 to 0.7. The manual reports Kuder-Richardson Formula 21 reliability coefficients for the test as: Language 0.83, Non-Language 0.80, and Total 0.88 as well as split-halves coefficients corrected by the Spearman-Brown Formula as: Language 0.95, Non-Language 0.91, and Total 0.95.

The test is simple to administer while the "Scoreze" sheets facilitate marking.

2. Laycock Mental Ability Test (1933). This test was administrated at the Grade 5 level. However, the data for the Elley (1961) study was collected in Grade 6. The test was developed and used extensively in Western Canada. It consists of 168 items in sub-tests named Classification, Analogies, Drawing Analogies, Opposites, Inferences, Number series, and Completion. The results are expressed in terms of the Total Intelligence Quotient only. The manual states that the object of the test is to measure Spearman's g factor since the test was constructed on the basis of Spearman's theory of intelligence (Laycock, 1935). The test educes relations and correlates through the various items. Although the test aims to measure g it is still considered to be a verbally and educationally loaded test. Seventy-five per cent of the items require verbal facility to a large extent.

Concurrent validity correlations with other popular intelligence tests are in the order of 0.8. The median correlation coefficients for average school achievement are about 0.6.

3. California Achievement Battery Junior High (1957). A description of this test is given on page 42 in the Grade 3 battery.

C. The Grade 7 Battery

1. Raven's Standard Progressive Matrices. According to studies performed, the Matrices appears to be a very promising culture-reduced test. The test is non-verbal, unspeeded, and easy to administer while the items are relatively free of educational attainment. Various British investigators have found high loading on the Spearman g factor in the test (Elley, 1961). The test author's basis upon which the test was constructed and what the test is supposed to do, likewise, imply the measurement of a more general type of ability. Raven (1958) said,"... Progressive Matrices was constructed on the a priori assumption that if Spearman's principles of noegenesis were correct it should provide a test suitable for comparing people with respect to their immediate capacities for observation and clear thinking." (Raven, 1958, p. 1.) However, Raven likewise suggested that in practical school intelligence test measurements a past-learning test such as the Mill Hill Vocabulary should be administered in conjunction with the Matrices (Cronbach, 1960, p. 217).

The test consists of five sets -- A, B, C, D, and E -- of 12 items each. Each item consists of a black and white matrix

with nine figures, one of which is missing. The examinee is to select a figure from six or eight figures below the matrix which would complete the pattern. The items become progressively more difficult. This makes the test suitable for use with a wide intellectual range of people.

In a study by Burke and Sinha, as reported by Burke (1958), an average reliability coefficient of 0.88 was found when the split-half Kuder-Richardson and an analysis of variance technique were used.

2. I.P.A.T. Cattell Test of g, "Culture-Free" Scale 2. This is a test which, according to the test author, is designed to measure general mental capacity and produce a single IQ score (Cattell, 1958). In this study it was used as one of the culture-reduced tests.

The Cattell Test of g has three scales covering the entire age range. Scale 2, which is designed for use with eight to thirteen-year-olds, was used in this investigation. The test has four sub-tests: the Series, Classifications, Matrices, and Conditions. In sub-test one, the testee must select a figure from a choice of five to complete a series of four figures, the last of which is missing. Sub-test two items contain six figures, one of which does not belong in that class. The subject must indicate the one that does not belong. The third sub-test has matrices similar to those in the Raven's test, whereas sub-test four requires the examinee to select a figure from a group of five which most resembles a given figure. Cattell said that this test is superior to the Raven's in the sense that it provides at least four different types of tasks

to perform against Raven's one. The test has 46 items and takes twelve and one-half minutes to complete.

The validity of the test as a measure of intelligence is supported by correlations of 0.71 with the Stanford-Binet, 0.73 with the Otis, and 0.59 with the American Council Psychological Examination (ACE) (Buros, 1958-59). Cattell (1958) reported an immediate test re-test reliability coefficient of 0.85 for 450 British secondary school entrants and split-half coefficients of 0.70, 0.86, 0.87, and 0.92 for four other samples.

4. Lorge-Thorndike Non-Verbal Intelligence Test Level 4 (1957). This is another test that will be classified as a culture-reduced instrument. The test constructors used Spearman's and Terman's concepts of intelligence to develop the test (Elley, 1961). It is a fairly recent American test which is easy to administer, is timed, and, with the exception of the instructions, is non-verbal. The test consists of three sub-tests: Figure Classification, Number Series, and Figure Analogies. The Figure Classification sub-test tasks are similar to Cattell's Figure Series items. The Number Series requires knowledge of numbers and, consequently, is somewhat dependent on past school learning. The Figure Analogies section employs the usual analogies principle; however, it is completely in terms of non-verbal figure symbols.

The authors reported an odd-even reliability coefficient on the Non-Verbal test of 0.928 and an alternate forms coefficient of 0.776 (Lorge and Thorndike, 1957). The tests are avowed to have high construct validity and measure abstract intelligence in terms of pictorial, diagrammatic, and numerical symbols

(Lorge and Thorndike, 1957). The manual shows that the correlation coefficient between the Lorge-Thorndike Non-Verbal and the CTMM is 0.73, the Otis is 0.66, the Stanford-Binet is 0.71, and the WISC is 0.77.

4. California Test of Mental Maturity Short-Form Elementary (1957). This test was described on page 43 in the Grade 6 battery.

5. Socio-Economic Score. This score was obtained from a combination of the Blishen Canadian Occupational Scale and a modified version of Gough's Home Index (1949). The Blishen Scale was constructed on the basis of occupational levels taking, with equal weighting, the average years of training and the average income for each occupation. The mean established was 50.0 and the standard deviation was 10.0. The occupations ranged from a judge with a score of 90.0 to hunters and trappers with a score of 32.0. Gough's Home Index was partially described in Chapter II. A pilot study performed by Elley was initiated to determine how the Home Index should be modified for his 1961 study, as well as for subsequent studies in the Edmonton area. The final Index as shown in Appendix B contains 14 items from the original scale, as well as six new ones. The modified Home Index score is based on a total of 20 points. Elley calculated the reliability coefficient for the modified scale using the split-half method, correcting it by the Spearman-Brown Formula, and found it to be 0.77 on his 432 sample. Gough's reliability for the original scale was 0.74. The items seemed to suggest that the modified index had good face validity. Elley found, when he used his 271 sample, that the new Home Index scale correlated 0.61 with Blishen's Occupational

Scale. The two scores, the Blishen and the Home Index were, on the basis of Elley's 271 sample, converted to standard scores with a mean of 25.0 and a standard deviation of 5.0. The two scores were then averaged, with equal weighting, to obtain the Socio-Economic Score.

D. The Grade 9 Battery

1. The Grade 9 Department of Education Final Examinations (1962). The Grade 9 results in this prediction study were the criteria. Scores for Literature, Language, Social Studies, Mathematics, and Science were obtained for the 263 cases. These cases were used to form the Grade 3 Sample consisting of 207 pupils and the Grade 6-7 Sample of 237. The Literature and Language scores were combined with equal weight into an average Literature-Language score. The five original scores were also combined, with unit weight, to produce an average Grade 9 Total score. The five scores actually used were the Literature-Language, Social Studies, Mathematics, Science, and Total. The scores for these tests were obtained from the Department of Education in percentage form. Using the simple ratio method, the Department transformed the raw scores into percentages. According to the Department, the distribution of the marks was "quite normal" and therefore no normalizing statistical procedures were performed. The scores were, however, arranged into such a distribution where ten per cent of the scores fell into the 0 to 39 per cent range, thirty per cent fell into the 40 to 49 per cent range, twenty-five per cent fell into the 50 to 64 per cent range, twenty-five per cent into the 65 to 79 per cent

range, and ten per cent into the 80 to 100 per cent range.

The Grade 9 Departmental examinations may be considered to be quite representative of the Grade 9 curriculum requirements.

Analysis of Data

Throughout the study various statistical tests were carried out for the two Samples, whose individual cases differ by 56. These 56 are cases that belonged to one of the two Samples only. Statistical results for the Grade 3 Sample of 207 and the Grade 6-7 Sample of 237 were in some instances compared, keeping in mind that the two samples do not contain exactly the same cases. The Grade 3 and the Grade 6-7 Samples were also compared on the basis of Laycock Intelligence Quotient, sex, and occupational level to the randomly chosen sample of 432 pupils drawn from the Edmonton Grade 6 Survey. This was done to determine the extent to which the 207 and 237 Samples are representative of the Edmonton population.

Frequency distributions were made of the raw scores for all the variables for the two Samples. By inspection the writer has decided that the distributions were sufficiently normal. This enabled raw data to be used where correlational procedures were involved. In analyses involving means and standard deviations the raw score data were T-scored over both Samples.

The Grade 3 and Grade 6-7 Samples were also compared to Elley's sample to see if there were any significant differences in terms of IQ, occupational level, and sex. Since Elley did not find significant sex differences for his 271 sample, and since the present two Samples were not significantly different from Elley's sample, this study was carried out under the assumption

that sex will not contribute a significant influence on test score variance. Consequently, there were no separate analyses for boys and for girls.

In this study, all the zero order correlations, the multiple correlation coefficients, and the beta weights were calculated with the IBM 1620 computer at the University of Alberta Computing Centre. All other calculations were performed by the use of the conventional hand calculator.

Hypothesis 1. Calculations for the Grade 3 and Grade 6-7 Samples were made using the three socio-economic level Groups for each Sample. All the data for Hypothesis 1 were used in the raw score form. Zero order correlations for the various culture-loaded tests and for the culture-reduced ones were obtained for the Grade 9 Total score and for the Upper, Middle, and Lower socio-economic Groups. Multiple correlations were obtained for combinations of culture-loaded plus culture-reduced tests for all the Groups with the Grade 9 Total scores. Differences between the zero order, as well as multiple correlation coefficients for the culture-loaded tests, and the multiple correlation coefficients for the culture-loaded plus culture-reduced tests, were observed for the three Groups. F values (Guilford, 1956, p. 400) for one-tailed tests were calculated to see which increases were significant. No statistical tests were performed to determine whether the increases, resulting from the inclusion of the culture-reduced tests with the conventional ones, for the Lower Group were significantly greater than for the Upper Group.

Beta weight values were obtained for the various predictors

in the multiple correlations and deviation regression equations were set up. The relative contributions by the various Grade 6-7 tests, towards the prediction of Grade 9 Total achievement, were pointed out.

Hypothesis 2. This hypothesis was primarily designed to work with the whole Grade 6-7 Sample. However, some of the calculations from the Hypothesis 1 data involving the different socio-economic groups were likewise used in this hypothesis. Data for this hypothesis were used in the raw form.

Part (a). Zero order correlation coefficients were calculated between culture-loaded as well as between culture-reduced tests and the five Grade 9 achievement scores for the whole Grade 6-7 Sample and for the different socio-economic Groups. Multiple correlation coefficients were calculated between the same tests and the Grade 9 Total score for the same Sample and Groups. Using calculations from this hypothesis as well as from Hypothesis 1, one-tailed tests were performed using Fisher's z to determine whether the culture-loaded tests, over this fairly short interval, yielded significantly higher coefficients in predicting Grade 9 achievement than did the culture-reduced tests.

Part (b). Zero order correlation coefficients were calculated between the achievement tests as well as all the ability tests and the five Grade 9 achievement scores for the whole Grade 6-7 Sample and for the three socio-economic Groups. Multiple correlation coefficients were calculated between the same tests and the Grade 9 Total scores for the same Sample and Groups. A number of the ability test coefficients were obtained from Part (a)

of this hypothesis. As in Part (a) one-tailed tests were performed to determine whether the achievement tests correlate significantly higher with Grade 9 achievement than do the ability tests.

Hypothesis 3. For this hypothesis it was necessary to T-score the Grade 3 achievement scores as well as the Grade 9 scores. The Grade 3 California Achievement Language, Arithmetic, and Total test means and standard deviations for the Upper and Lower socio-economic Groups in the Grade 3 Sample were calculated. The means and standard deviations for the Grade 9 Literature-Language, Mathematics, and Total scores for the three Groups of this same Sample were also computed. Critical ratios for the one-tailed test (Garrett, 1959, p. 226) were found to determine whether the Grade 9 achievement scores for the Upper Group were significantly higher, and the Grade 9 scores for the Lower Group were significantly lower, than the achievement scores for these respective Groups at Grade 3.

Hypothesis 4. This hypothesis is concerned with the effect that the Socio-Economic Score has on the predictive validity of intelligence and achievement tests. Raw data were used for the calculations. Multiple correlation coefficients were calculated between intelligence and achievement test scores plus the Socio-Economic Scores and the Grade 9 Total achievement scores for the whole Grade 6-7 Sample and for the three socio-economic Groups. These correlation coefficients were compared to the coefficients for these Grade 6-7 intelligence and achievement tests when they were used as predictors without the Socio-Economic Scores. F values

(Guilford, 1956, p. 400) for one-tailed tests were calculated to determine whether the inclusion of the S.E.S. significantly increased the predictive validity of intelligence and achievement tests. The magnitudes of the increases in the coefficients for the culture-reduced tests as compared to the increases for the culture-loaded ones were pointed out. The differences in the effect of the S.E.S. on predictive validity for the three socio-economic levels were investigated.

CHAPTER V

PRELIMINARY RESULTS

Sample Bias

The Grade 3 Sample of 207 and the Grade 6-7 Sample of 237 were drawn from Elley's 1961 study sample of 271 cases. His whole sample could not be used because of various dropouts, grade failures, and occasional missing marks for some particular tests in the battery. This necessitated the formation of the two Samples, one for the Grade 3 data and one for the Grade 6-7 data. Elley (1961, p. 96) compared his sample to the random sample of 432 and found no significant differences between the two groups in terms of means and standard deviations for the intelligence quotient, occupational level, and age. The two groups, likewise, did not differ significantly on the basis of percentage distribution by sex. The means, standard deviations, and percentages for the 432 random sample cases from the Grade 6 Edmonton Survey were used in this study to try to establish the representativeness of the Grade 3 Sample and the Grade 6-7 Sample. The means and standard deviations for the Laycock Intelligence Quotient and the Blishen Occupational Scale are shown in Tables III and IV. The percentage of boys and girls is also shown in these two tables. Calculations were performed to determine how the writer's Samples compared with the random sample and to indicate whether the Samples were representative of the Edmonton population. Using the null hypothesis, statistical tests were performed to show that there were no significant differences between the means, standard deviations, and percentages between the writer's two Samples and the random sample.

TABLE III

MEANS, STANDARD DEVIATIONS, PERCENTAGES, AND SIGNIFICANCE LEVELS OF AN EDMONTON GRADE 6 SURVEY RANDOM SAMPLE COMPARED WITH A SELECTED SAMPLE IDENTIFIED AS THE GRADE 3 SAMPLE ON THE BASIS OF THE LAYCOCK INTELLIGENCE QUOTIENT, BLISHEN'S CANADIAN OCCUPATIONAL SCALE SCORES, AND SEX

	Grade 6 Random Sample (N = 432)	Grade 3 Selected Sample (N = 207)	Mean Difference	t values	Significance	F values	Significance
IQ							
Mean	110.41	112.94	2.53	2.22	Sig. at 0.05 N.S. at 0.01	--	--
S.D.	13.57	13.02	--	--	--	1.09	N.S. at 0.05
Occupation							
Mean	51.63	53.41	1.78	2.20	Sig. at 0.05 N.S. at 0.01	--	--
S.D.	9.35	9.68	--	--	--	1.07	N.S. at 0.05
Sex							
Boys	50%	51.69%	--	0.51	N.S. at 0.05	--	--
Girls	50%	48.31%	--	0.51	N.S. at 0.05	--	--

TABLE IV

MEANS, STANDARD DEVIATIONS, PERCENTAGES, AND SIGNIFICANCE LEVELS OF AN EDMONTON GRADE 6 SURVEY RANDOM SAMPLE COMPARED WITH A SELECTED SAMPLE IDENTIFIED AS THE GRADE 6-7 SAMPLE ON THE BASIS OF THE LAYCOCK INTELLIGENCE QUOTIENT, BLISHEN'S CANADIAN OCCUPATIONAL SCALE SCORE, AND SEX

	Grade 6 Random Sample (N = 432)	Grade 6-7 Selected Sample (N = 237)	Mean Difference	t values	Significance	F values	Significance
IQ							
Mean	110.41	112.36	1.95	1.84	N.S. at 0.05	--	--
S.D.	13.57	12.89	--	--	--	1.66	N.S. at 0.05
Occupation							
Mean	51.63	53.52	1.89	2.43	Sig. at 0.05 N.S. at 0.01	--	--
S.D.	9.35	9.75	--	--	--	1.09	N.S. at 0.05
Sex							
Boys	50%	54.85%	--	1.50	N.S. at 0.05	--	--
Girls	50%	45.15%	--	1.50	N.S. at 0.05	--	--

By obtaining the appropriate t values (Garrett, 1959, p. 214), F ratios (Ferguson, 1959, p. 141), and ratios for differences of per cents (Garrett, 1959, p. 235), the null hypothesis was accepted for all statistics at the 0.01 level of significance and rejected at the 0.05 level only for the Grade 3 Intelligence Quotient Mean, the Grade 3 Occupational level mean, and the Grade 6-7 Occupational level mean. The reader will note that this does not suggest that no sampling bias exists. However, it does imply that the Samples used in this study, in terms of the statistics that were considered, were quite representative of the Edmonton population and that the results obtained in this study could be generalized to Edmonton students.

Sex Differences

Some studies on sex as a variable in test scores were discussed in earlier chapters. No conclusive evidence was presented. Elley (1961, pp. 97-102), however, investigated the effect of sex on the Raven's Progressive Matrices, California Achievement Reading Total, and the California Test of Mental Maturity Numerical test scores. He found no significant differences between the two sexes for any of the tests at the 0.01 nor the 0.05 levels. These tests were not carried out by the present writer although the assumption that no sex differences exist in the Grade 3 and Grade 6-7 Samples, was further substantiated by a comparison of Elley's 271 sample with the writer's two Samples in the same way that the comparison with the random 432 cases was made in the previous section. Tables V and VI show no significant differences between the two Samples and Elley's sample in terms of means and standard

TABLE V

MEANS, STANDARD DEVIATIONS, PERCENTAGES, AND SIGNIFICANCE LEVELS OF THE ELLEY GRADE 7 SAMPLE OF 271 CASES COMPARED WITH A SELECTED SAMPLE IDENTIFIED AS THE GRADE 3 SAMPLE ON THE BASIS OF THE LAYCOCK INTELLIGENCE QUOTIENT, BLISHEN'S CANADIAN OCCUPATIONAL SCALE SCORE, AND SEX

	Grade 7 Elley Sample (N = 271)	Grade 3 Selected Sample (N = 207)	Mean Difference	t values	Significance	F values	Significance
IQ							
Mean	111.64	112.94	1.30	1.04	N.S. at 0.05	--	--
S.D.	13.24	13.02	--	--	--	1.03	N.S. at 0.05
Occupation							
Mean	52.84	53.41	0.57	0.63	N.S. at 0.05	--	--
S.D.	10.09	9.68	--	--	--	1.09	N.S. at 0.05
Sex							
Boys	46.1%	51.69%	--	1.22	N.S. at 0.05	--	--
Girls	53.9%	48.31%	--	1.22	N.S. at 0.05	--	--

TABLE VI

MEANS, STANDARD DEVIATIONS, PERCENTAGES, AND SIGNIFICANCE LEVELS OF THE ELLEY GRADE 7 SAMPLE OF 271 CASES COMPARED WITH A SELECTED SAMPLE IDENTIFIED AS THE GRADE 6-7 SAMPLE ON THE BASIS OF THE LAYCOCK INTELLIGENCE QUOTIENT, BLISHEN'S CANADIAN OCCUPATIONAL SCALE SCORE, AND SEX

	Grade 7 Elley Sample (N = 271)	Grade 6-7 Selected Sample (N = 237)	Mean Difference	t values	Significance	F values	Significance
IQ							
Mean	111.64	112.36	0.72	0.62	N.S. at 0.05	--	--
S.D.	13.24	12.89	--	--	--	1.05	N.S. at 0.05
Occupation							
Mean	52.84	53.52	0.68	0.77	N.S. at 0.05	--	--
S.D.	10.09	9.75	--	--	--	1.07	N.S. at 0.05
Sex							
Boys	46.1%	54.77%	--	1.95	N.S. at 0.05	--	--
Girls	53.9%	45.23%	--	1.95	N.S. at 0.05	--	--

deviations for the IQ scores and for the occupational level scores, and in terms of percentage distribution by sex. On the basis of the results of these statistical tests the writer concluded that sex will not be a significant variable in determining test scores in the two Samples used in this study. Consequently, no separate analyses were performed for boys and girls in this report.

Summary

1. The Grade 3 Sample of 207 cases and the Grade 6-7 Sample of 237 cases showed no significant differences at the 0.01 level between the 432 random sample on the Laycock Intelligence Quotient, the Blishen Occupational Scale score, and sex. There were significant differences at the 0.05 level for a few of the means. On the strength of these results it has been decided that findings from this study can be safely generalized to the Edmonton population.
2. The writer's Samples were compared to Elley's (1961) 271 sample on the basis of the Laycock Intelligence Quotient, the Blishen Occupational Scale score, and sex. No significant differences appeared even at the 0.05 level for any of the variables that were considered. On the basis of previous studies, and the similarity between the Samples in this study and Elley's sample, the writer proceeded on the assumption that sex was not a significant variable in test scores.

CHAPTER VI

EFFECT OF CULTURE-REDUCED TESTS ON PREDICTIVE VALIDITY

Hypothesis 1 was evolved from the assumption that the performance of pupils from lower socio-economic status levels on conventional verbal tests administered in the early grades will not indicate their performance accurately in school in later years. It was hypothesized that these early measures with the conventional educationally loaded tests usually underestimate the ability of these students, and that tests which are less dependent on learning from a previous specific cultural environment, should be used to supplement the conventional tests. Assuming that these students from the lower socio-economic levels receive some adaptive treatment they could develop their present potential ability and display it in terms of performance, commensurate with this potential ability, on conventional verbal tests. Hypothesis 1 states, then, that in addition to the conventional predictors used in Grades 3, 6, and 7, culture-reduced intelligence tests should be used to increase the ability of the conventional tests to predict Grade 9 achievement, especially for the lower socio-economic level pupils.

Tables VIII and IX were first examined with respect to the magnitudes of the prediction coefficients for the conventional tests, as well as, the differences in predictability among the Groups. From Tables VII and VIII it is apparent that the coefficients for predicting Grade 9 Total achievement using the California Test of Mental Maturity Language (CTMM Lang.) score at Grade 3 are low for all Groups. For this six-year interval the coefficient of 0.213 for the Lower Group is not even

TABLE VII

ZERO ORDER CORRELATION COEFFICIENTS FROM INTELLIGENCE TEST SCORES OBTAINED IN GRADE 3 CORRELATED WITH FIVE GRADE 9 ACHIEVEMENT SCORES FOR THE TOTAL GRADE 3 SAMPLE AND THE THREE SOCIO-ECONOMIC GROUPS

T - N = 207 U, M, L - N = 69

Grade 9 Test	Sample or Group	Grade 3 Intelligence Tests: Calif. Test of Mental Maturity Language	Calif. Test of Mental Maturity Non-Language	Raven's Coloured Progressive Matrices
Total	T	.339	.144	.273
	U	.365	.183	.286
	M	.349	.196	.364
	L	.213	.047	.164
Science	T	.304	.180	.306
	U	.396	.216	.390
	M	.215	.179	.347
	L	.215	.124	.165
Mathe-matics	T	.299	.214	.350
	U	.201	.159	.315
	M	.314	.186	.408
	L	.290	.274	.307
Social Studies	T	.403	.158	.268
	U	.430	.145	.274
	M	.328	.068	.298
	L	.359	.233	.216
Literature-Language	T	.303	.162	.202
	U	.229	.203	.177
	M	.286	.209	.204
	L	.251	.068	.187

The underlined coefficients are not significant at the 0.05 level.

T - Total Sample
U - Upper Socio-economic Group
M - Middle Socio-economic Group
L - Lower Socio-economic Group

TABLE VIII

PREDICTION COEFFICIENTS FROM INTELLIGENCE TEST SCORES OBTAINED IN GRADE 3 CORRELATED WITH GRADE 9 TOTAL ACHIEVEMENT SCORES FOR THE THREE SOCIO-ECONOMIC GROUPS FROM THE GRADE 3 SAMPLE

		Upper Group N = 69	Middle Group N = 69	Lower Group N = 69
Conventional	CTMM Lang.	.365	.349	.213
Conventional + Culture-Reduced	CTMM Lang. + Non-L.	.366	.363	.214
	CTMM Lang. + Raven's Coloured Prog. Mat.	.411	.395	.235
	CTMM Lang. + Non-L. + Raven's Coloured Prog. Mat.	.413	.408	.242

The underlined coefficients are not significant at the 0.05 level.

TABLE IX

PREDICTION COEFFICIENTS FROM INTELLIGENCE TESTS SCORES OBTAINED IN GRADES 6 AND 7 CORRELATED WITH GRADE 9 TOTAL ACHIEVEMENT FOR THE THREE SOCIO-ECONOMIC GROUPS FROM THE GRADE 6-7 SAMPLE

Conventional	Upper Group N = 79	Middle Group N = 79	Lower Group N = 79
1	.517	.471	.357
3	.601	.547	.335
1, 3	.619	.554	.368
13	.502	.557	.404

Conventional + Culture Reduced	Upper Group N = 79	Middle Group N = 79	Lower Group N = 79
1, 2	.538	.498	.368
1, 7	.591	.490	.367
1, 8	.574	.541	.391
1, 7, 8	.599	.542	.392
3, 7	.629	.552	.346
3, 7, 8	.632	.583	.371
3, 12	.602	.579	.350
1, 3, 2	.640	.569	.396
1, 3, 7	.659	.563	.385
1, 3, 8	.652	.586	.405
1, 3, 7, 8	.660	.588	.406
13, 14	.538	.570	.418
13, 12, 14	.555	.581	.424
13, 7	.556	.563	.409
13, 8	.534	.592	.416
13, 7, 8	.564	.598	.420

Conventional tests are underlined

Test Code:

1. California Test of Mental Maturity Lang. (Gr. 6).
2. California Test of Mental Maturity Non-Lang. (Gr. 6).
3. Laycock Mental Ability Test.
7. Raven's Standard Progressive Matrices.
8. Cattell "Culture-Free" Test of g - I.P.A.T.
12. Lorge-Thorndike Non-Verbal Total.
13. California Test of Mental Maturity Lang. (Gr. 7).
14. California Test of Mental Maturity Non-Lang. (Gr. 7).

All the coefficients are significantly different from zero at 0.05 level.

significantly different from zero at the 0.05 level. However, the predictor coefficients for the Grade 6-7 Sample (Table IX), in predicting Grade 9 Total achievement, are all significantly different from zero at the 0.01 level. The tendency for the prediction coefficients to be highest for the Upper Group and to decrease progressively for the Middle and Lower Groups in both the Grade 3 and Grade 6-7 Samples, was apparent for most of the variables. For the Grade 6-7 Sample, differences between the Upper and Lower Group coefficients were significant at the 0.05 level for the Laycock and for the CTMM Lang. plus Laycock. The general trend for the different Groups with respect to predictability with conventional tests is as was expected, with the Laycock seemingly discriminating most between the Upper and Lower Groups. The Upper and Middle Groups, it appears, took advantage of the verbal and educational conventional tests for predicting Grade 9 Total performance which is likewise based on verbal and educational tasks.

Addition of Culture-Reduced Predictors to Conventional Predictors

The addition of the culture-reduced predictors to the conventional ones did not produce any significant (at the 0.05 level) increases in prediction for any of the Grade 3 Groups. However, Table X shows that the F values for the Upper and Middle Groups are considerably higher than for the Lower Group. For this six-year prediction interval the coefficients were low and if the usual statistical methods of evaluating the coefficient increases were employed it would not have been possible to determine whether any of the Groups benefited significantly more than

TABLE X

F VALUES SHOWING INCREASES IN PREDICTIVE CORRELATION COEFFICIENTS BROUGHT ABOUT BY INTRODUCING VARIOUS CULTURE-REDUCED INTELLIGENCE TESTS TO CONVENTIONAL INTELLIGENCE TESTS IN GRADE 3 TO PREDICT GRADE 9 TOTAL ACHIEVEMENT FOR THE THREE SOCIO-ECONOMIC GROUPS FROM THE GRADE 3 SAMPLE

Conventional Test	Tests Added to Conventional Test	Upper Group N = 69	Middle Group N = 69	Lower Group N = 69
California Test of Mental Maturity, Language (Primary)	CTMM Non-L.	0.66	0.76	0.03
	Raven's Coloured Prog. Mat.	2.83	2.68	0.69
	CTMM Non-L. + Raven's Coloured Prog. Mat.	1.49	1.77	0.46

	0.01 Sig.	0.05 Sig.
$df_{1,66}$	$\infty \geqslant F \geqslant 7.04$ - ***	$7.04 > F \geqslant 3.99$ - **
$df_{2,65}$	$\infty \geqslant F \geqslant 4.95$ - ***	$4.95 > F \geqslant 3.14$ - **

others from the addition of culture-reduced predictors.

Table XI shows that for the Grade 6-7 Groups, the addition of the culture-reduced tests produced, in a number of cases, significant increases at the 0.05 and 0.01 levels for the Upper and Middle Groups. However, they produced no increases for the Lower Group. Most of the significant increases indicated were for the Upper Group. In a few instances the increases were more significant for the Middle Group than for the Upper one. Table XI also indicates, in terms of different F ratios, that the Cattell "Culture-Free" test of g (I.P.A.T.) and the Lorge-Thorndike Non-Verbal (L-T N-V), when added to conventional tests in Grades 6 and 7, contributed more to the predictive ability than other culture-reduced tests for the Middle and Lower Groups whereas the Raven's Standard Progressive Matrices (RPM) always contributed more than any other culture-reduced tests did for the Upper Group. The beta weights in Table XII showed that the RPM was always less influential in the Middle and Lower Groups and more influential in the Upper Group than the I.P.A.T. test. In the presence of the I.P.A.T. test the RPM acted as a suppressor for the Middle and Lower Groups when these are combined with any of the conventional predictors. However, the RPM contributed positively towards increasing the prediction for the Upper Group.

Explanation of Results

Of importance to this portion of the study was the finding here, as well as in the results for Hypothesis 2, that future performance for the Lower Group cannot be predicted with too much accuracy with any of the predictors used in this study.

TABLE XI

F VALUES SHOWING INCREASES IN PREDICTIVE CORRELATION COEFFICIENTS BROUGHT ABOUT BY INTRODUCING VARIOUS CULTURE-REDUCED INTELLIGENCE TESTS TO CONVENTIONAL INTELLIGENCE TESTS IN GRADES 6 AND 7 TO PREDICT GRADE 9 TOTAL ACHIEVEMENT FOR THE THREE SOCIO-ECONOMIC GROUPS FROM THE GRADE 6-7 SAMPLE

Conventional Test(s)	Tests Added to Conventional Tests	Upper Group N = 79	Middle Group N = 79	Lower Group N = 79
California Test of Mental Maturity S-Form Elem. Lang. (Gr. 6)	CTMM Non-L.	2.38	2.64	0.70
	Raven's St.Prog.Mat.	9.58***	1.84	0.69
	Cattell I.P.A.T.	7.05***	7.61***	2.05
	Raven's St.Prog.Mat. + Cattell I.P.A.T.	5.42***	3.87**	1.07
Laycock Mental Ability Test	Raven's St.Prog.Mat.	4.34**	0.60	0.65
	Raven's St.Prog.Mat. + Cattell I.P.A.T.	2.42	2.34	1.12
	Lorge-Thorndike N-V	0.14	4.12**	0.89
California Test of Mental Maturity S-Form Elem. Lang. (Gr. 6) + Laycock Mental Ability Test	CTMM Non-L.	3.36	1.98	1.90
	Raven's St.Prog.Mat.	6.78***	1.10	1.13
	Cattell I.P.A.T.	5.47**	4.17**	2.57
	Raven's St.Prog.Mat. + Cattell I.P.A.T.	3.48**	2.23	1.33
California Test of Mental Maturity S-Form Elem. Lang. (Gr. 7)	CTMM Non-L.	3.95	1.63	1.05
	Lorge-Thorndike N-V + CTMM Non-L.	3.04	1.55	0.76
	Raven's St.Prog.Mat.	6.20**	0.74	0.37
	Cattell I.P.A.T.	3.48	4.64**	0.89
	Raven's St.Prog.Mat. + Cattell I.P.A.T.	3.63**	2.76	0.60

	0.01 Sig.	0.05 Sig.
$df_{1,76}$	$\infty \geq F \geq 6.98$ - ***	$6.98 > F \geq 3.97$ - **
$df_{2,75}$	$\infty \geq F \geq 4.90$ - ***	$4.90 > F \geq 3.12$ - **
$df_{3,74}$	$\infty \geq F \geq 4.06$ - ***	$4.06 > F \geq 2.73$ - **

TABLE XII

BETA WEIGHTS AND DEVIATION MULTIPLE REGRESSION EQUATIONS FOR VARIOUS COMBINATIONS OF INTELLIGENCE TESTS AT GRADES 6 AND 7 IN PREDICTING GRADE 9 TOTAL ACHIEVEMENT FOR THE UPPER, MIDDLE, AND LOWER SOCIO-ECONOMIC GROUPS FROM THE GRADE 6-7 SAMPLE

Predictors	Socio-Econ. Group	Beta Weights for Respective Predictors			Multiple Regression Equations in Deviation Form
	U	.48	.12		$\bar{z} = 0.48z_1 + 0.12z_2$
1,2	M	.42	.14		$\bar{z} = 0.42z_1 + 0.14z_2$
	L	.38	-.05		$\bar{z} = 0.38z_1 - 0.05z_2$
	U	.42	.28		$\bar{z} = 0.42z_1 + 0.28z_2$
1,7	M	.42	.12		$\bar{z} = 0.42z_1 + 0.12z_2$
	L	.33	.06		$\bar{z} = 0.33z_1 + 0.06z_2$
	U	.47	.22		$\bar{z} = 0.47z_1 + 0.22z_2$
1,8	M	.33	.28		$\bar{z} = 0.33z_1 + 0.28z_2$
	L	.32	.10		$\bar{z} = 0.32z_1 + 0.10z_2$
	U	.40	.23	.15	$\bar{z} = 0.40z_1 + 0.23z_2 + 0.15z_3$
1,7,8	M	.34	-.03	.30	$\bar{z} = 0.34z_1 - 0.03z_2 + 0.30z_3$
	L	.33	-.01	.11	$\bar{z} = 0.33z_1 - 0.01z_2 + 0.11z_3$
	U	.51	.21		$\bar{z} = 0.51z_1 + 0.21z_2$
3,7	M	.52	.05		$\bar{z} = 0.52z_1 + 0.05z_2$
	L	.31	.06		$\bar{z} = 0.31z_1 + 0.06z_2$
	U	.49	.19	.07	$\bar{z} = 0.49z_1 + 0.19z_2 + 0.07z_3$
3,7,8	M	.44	-.06	.24	$\bar{z} = 0.44z_1 - 0.06z_2 + 0.24z_3$
	L	.30	.00	.11	$\bar{z} = 0.30z_1 + 0.00z_2 + 0.11z_3$
	U	.57	.05		$\bar{z} = 0.57z_1 + 0.05z_2$
3,12	M	.45	.19		$\bar{z} = 0.45z_1 + 0.19z_2$
	L	.30	.06		$\bar{z} = 0.30z_1 + 0.06z_2$

Conventional predictors are underlined.
Test Code:
1 - California Test of Mental Maturity Lang. (Gr. 6).
2 - California Test of Mental Maturity Non-Lang. (Gr. 6).
3 - Laycock Mental Ability Test.
7 - Raven's Standard Progressive Matrices.
8 - Cattell "Culture-Free" Test of g - I.P.A.T.
12 - Lorge-Thorndike Non-Verbal Total.
13 - California Test of Mental Maturity Lang. (Gr. 7).
14 - California Test of Mental Maturity Non-Lang. (Gr. 7).

(Table XII continued on next page)

TABLE XII

BETA WEIGHTS AND DEVIATION MULTIPLE REGRESSION EQUATIONS FOR VARIOUS COMBINATIONS OF INTELLIGENCE TESTS AT GRADES 6 AND 7 IN PREDICTING GRADE 9 TOTAL ACHIEVEMENT FOR THE UPPER, MIDDLE, AND LOWER SOCIO-ECONOMIC GROUPS FROM THE GRADE 6-7 SAMPLE

Predictors	Socio-Econ. Group	Beta Weights for Respective Predictors				Multiple Regression Equations in Deviation Form
1,3,2	U	.23	.45	.28		$\bar{z} = 0.23z_1 + 0.45z_2 + 0.28z_3$
	M	.14	.41	.09		$\bar{z} = 0.14z_1 + 0.41z_2 + 0.09z_3$
	L	.26	.20	-.09		$\bar{z} = 0.26z_1 + 0.20z_2 - 0.09z_3$
1,3,7	U	.21	.39	.19		$\bar{z} = 0.21z_1 + 0.39z_2 + 0.19z_3$
	M	.15	.42	.04		$\bar{z} = 0.15z_1 + 0.42z_2 + 0.04z_3$
	L	.23	.16	.03		$\bar{z} = 0.23z_1 + 0.16z_2 + 0.03z_3$
1,3,8	U	.23	.41	.12		$\bar{z} = 0.23z_1 + 0.41z_2 + 0.12z_3$
	M	.12	.35	.19		$\bar{z} = 0.12z_1 + 0.35z_2 + 0.19z_3$
	L	.23	.15	.09		$\bar{z} = 0.23z_1 + 0.15z_2 + 0.09z_3$
1,3,7,8	U	.21	.37	.17	.08	$\bar{z} = 0.21z_1 + 0.37z_2 + 0.17z_3 + 0.08z_4$
	M	.12	.36	-.06	.23	$\bar{z} = 0.12z_1 + 0.36z_2 - 0.06z_3 + 0.23z_4$
	L	.23	.16	-.03	.10	$\bar{z} = 0.23z_1 + 0.16z_2 - 0.03z_3 + 0.10z_4$
13,14	U	.41	.19			$\bar{z} = 0.41z_1 + 0.19z_2$
	M	.51	.10			$\bar{z} = 0.51z_1 + 0.10z_2$
	L	.38	.06			$\bar{z} = 0.38z_1 + 0.06z_2$
13,12,14	U	.39	.14	.12		$\bar{z} = 0.39z_1 + 0.14z_2 + 0.12z_3$
	M	.46	.15	.03		$\bar{z} = 0.46z_1 + 0.15z_2 + 0.03z_3$
	L	.36	.06	.04		$\bar{z} = 0.36z_1 + 0.06z_2 + 0.04z_3$
13,7	U	.38	.24			$\bar{z} = 0.38z_1 + 0.24z_2$
	M	.53	.07			$\bar{z} = 0.53z_1 + 0.07z_2$
	L	.40	.02			$\bar{z} = 0.40z_1 + 0.02z_2$
13,8	U	.44	.16			$\bar{z} = 0.44z_1 + 0.16z_2$
	M	.45	.22			$\bar{z} = 0.45z_1 + 0.22z_2$
	L	.38	.15			$\bar{z} = 0.38z_1 + 0.15z_2$
13,7,8	U	.36	.24	.10		$\bar{z} = 0.36z_1 + 0.24z_2 + 0.10z_3$
	M	.45	-.05	.25		$\bar{z} = 0.45z_1 - 0.05z_2 + 0.25z_3$
	L	.39	-.01	.10		$\bar{z} = 0.39z_1 - 0.01z_2 + 0.10z_3$

Conventional predictors are underlined.

See previous page for test code.

The Upper Group and in many instances the Middle Group took full advantage, because of their verbal and educational background, of the conventional predictor tests in predicting to the verbal type of criterion, which is the Grade 9 academic school achievement. Therefore, before we combined the culture-reduced tests with the conventional ones we already had a large difference, in some cases significant, between prediction correlation coefficients of the Upper and the Lower Groups. While attempting to evaluate the increases for the two Groups, in order to be able to suggest which one benefited most from the addition of the culture-reduced tests, we run into the non-linear aspect of the predictability of a correlation coefficient. On the basis of statistical tests the difference between 0.70 and 0.80 does not have the same significance as the difference between 0.20 and 0.30. In view of this, as well as the fact that the Groups consisted of only 69 or 79 cases, the writer has decided to discuss some of the findings in terms of trends and tendencies in addition to tested statistical conclusions.

From Tables VIII and IX and Table XIII on pages 64, 65, and 76 it is apparent that the Upper Group performance was more predictable than the Lower Group for any predictor test used. Predictors for the Upper, and in many cases the Middle Groups, would probably benefit more than the predictors for the Lower Group from the addition of any ability test, not necessarily from a culture-reduced one. Under the circumstances in the schools, it appeared that a test such as the I.P.A.T. or the L-T N-V, as a result of the types of tasks they presented,

contributed more to the predictability of Grade 9 achievement for the Lower Group than tests such as the RPM, which are considered to be more culture-reduced. Although the verbal tests were somewhat foreign to the Lower Group, yet because the Grade 9 achievement tests were culturally and educationally oriented, these less culture-reduced tests contributed somewhat more towards prediction than did the very culture-reduced ones. On the other hand, the results showed that the RPM was a more useful addition for the Upper Group than any other culture-reduced test. For this Group, it appeared that whatever the conventional tests at Grades 6 and 7 did not measure to allow accurate prediction of Grade 9 achievement, a highly culture-reduced test such as the RPM would measure it. The high culture-reduced test was a good compliment for the other predictors. A less culture-reduced test was not as useful for the Upper Group since it already made full use of the original conventional tests. A test such as the L-T N-V, which probably measures constructs more similar to those that conventional tests measure than does the RPM, does not increase the predictive validity as significantly for the Upper Group as the RPM does.

Summary

If the tests in this study could be considered to be representative of the various types of tests used in the schools it would appear that under the present treatment none of the present ability tests enable us to predict, with any degree of accuracy, the performance, at a later date, of pupils from the low socio-economic status levels in the Edmonton area. The addition of culture-reduced tests increases the predictive ability

of conventional tests for all the Groups. The increases were found to be significant at the 0.05 and 0.01 levels for the Upper and Middle Groups and not significant for the Lower Group. Probably, because of the nature of the criterion and the type of treatment offered to the pupils during the prediction interval, there was a tendency pointing out that less culture-reduced tests increased prediction for the Lower Group more than the more culture-reduced tests did. When added to conventional tests, tests such as the I.P.A.T. and the L-T N-V, increased prediction more than the RPM for the Lower and in some cases the Middle Groups. The Upper Group seemed to benefit most from the introduction of the RPM.

The hypothesis that the culture-reduced tests will increase the predictive ability of conventional tests significantly more for the Lower Group than for the Upper Group has not been upheld by the results obtained. The results did, however, indicate some of the effects that the culture-reduced ability tests have when combined with conventional ability tests to predict future achievement for pupils of different socio-economic levels. To persue the original hypothesis it should be remembered that the type of criteria, the treatment offered during the prediction interval, and the length of the interval are all likely to be consequential in establishing appropriate predictors for pupils from various socio-economic strata.

CHAPTER VII

PREDICTING ACHIEVEMENT WITH CONVENTIONAL AND CULTURE-REDUCED ABILITY TESTS AND ACHIEVEMENT TESTS

Ability Tests as Predictors

The first part of Hypothesis 2 stated that, under circumstances similar to those in our schools, the conventional ability tests administered in Grades 6 and 7 will predict Grade 9 achievement more accurately for the whole Sample than will culture-reduced ability tests. In discussing the results for this part of the study it is important to keep in mind the magnitudes and the significance of the prediction coefficients shown in Tables XIII and XIV.

The Total Grade 6-7 Sample. Each conventional ability test was a significantly better predictor of Grade 9 Total achievement at the 0.05 or 0.01 level than any culture-reduced test for the Total Grade 6-7 Sample. Almost identical results were obtained for the whole Sample in predicting Grade 9 Social Studies and Grade 9 Literature-Language. There were some cases where the significance was, as shown in Table XV, only at the 0.10 level. Table XV also shows that combinations of conventional tests are all significantly better predictors of Grade 9 Total achievement at the 0.05 and 0.01 levels than various combinations of culture-reduced tests.

Of interest was the lack of any superiority of the conventional over culture-reduced tests for predicting Grade 9 Science. A negative (Table XV), though not significant, trend

TABLE XIII

(see over)

TABLE XIII

CORRELATION COEFFICIENTS BETWEEN GRADES 6 AND 7 ABILITY AND ACHIEVEMENT TEST SCORES AND VARIOUS GRADE 9 ACHIEVEMENT SCORES FOR THE WHOLE GRADE 6-7 SAMPLE AND THE DIFFERENT SOCIO-ECONOMIC GROUPS

		Gr. 9 Total				Gr. 9 Science			
		T	U	M	L	T	U	M	L
Conventional Ability Tests	Calif. Test of Ment. Mat. Lang. (Gr.6)	.496	.517	.471	.357	.386	.378	.407	.231
	Laycock Ment. Abil. Test	.534	.601	.547	.335	.421	.508	.387	.243
	Calif. Test of Ment. Mat. Lang. (Gr.7)	.534	.502	.557	.404	.451	.398	.492	.326
Culture-Reduced Ability Tests	Calif. Test of Ment. Mat. N-L (Gr.6)	.242	.259	.301	.129	.271	.324	.314	.137
	Raven's Standard Prog. Mat.	.312	.429	.284	.187	.327	.432	.275	.247
	Cattell "Culture-Free" I.P.A.T.	.358	.331	.446	.208	.373	.318	.433	.297
	Lorge-Thorndike Non-Verbal	.366	.358	.423	.235	.325	.330	.338	.218
	Calif. Test of Ment. Mat. N-L (Gr.7)	.315	.382	.339	.196	.332	.402	.254	.295
Achievement Tests	Calif. Achievement Reading	.518	.535	.550	.349	.364	.381	.342	.229
	Calif. Achievement Arithmetic	.409	.460	.503	.247	.326	.396	.358	.203
	Calif. Achievement Language	.443	.482	.521	.215	.251	.315	.242	.171

T - Total Grade 6-7 Sample N = 237
U - Upper socio-economic Group N = 79
M - Middle socio-economic Group N = 79
L - Lower socio-economic Group N = 79

Thirds from Total Grade 6-7 Sample

Significance of r's: N = 237 0.05 level r = 0.138

N = 79 0.05 level r = 0.217

Gr. 9 Math.				Gr. 9 Soc. St.				Gr. 9 Lit.-Lang.			
T	U	M	L	T	U	M	L	T	U	M	L
.359	.353	.357	.221	.452	.571	.295	.346	.490	.667	.350	.324
.366	.377	.377	.209	.452	.490	.350	.361	.498	.582	.495	.267
.407	.425	.406	.244	.529	.591	.434	.429	.500	.638	.440	.276
.295	.349	.372	.126	.211	.233	.171	.193	.149	.234	.190	.027
.375	.545	.295	.286	.266	.427	.141	.216	.215	.422	.173	.016
.396	.405	.440	.265	.326	.322	.310	.238	.280	.379	.327	.006
.396	.485	.422	.228	.313	.264	.339	.228	.353	.437	.358	.188
.424	.506	.398	.351	.291	.451	.200	.198	.246	.370	.297	.044
.412	.410	.461	.238	.538	.618	.476	.419	.514	.730	.437	.275
.387	.477	.374	.295	.433	.579	.424	.289	.421	.586	.458	.202
.315	.325	.329	.178	.370	.403	.371	.200	.583	.710	.615	.334

TABLE XIV

MULTIPLE CORRELATION COEFFICIENTS BETWEEN VARIOUS ABILITY AND ACHIEVEMENT TEST SCORES AT GRADES 6 AND 7 AND GRADE 9 TOTAL ACHIEVEMENT FOR THE TOTAL GRADE 6-7 SAMPLE

N = 237

Conventional Ability Tests		Culture-Reduced Ability Tests					Conventional + Culture-Reduced Ability Tests					Achievement Tests			
1,3	3,13	7,8	2, 7,8	7,8, 12	7,8, 12,14	7,8, 14	1,2, 3	7,8, 13,14	7,8, 13	1,2	12,13, 14	4,5, 6	4,5	4,6	5,6
.559	.576	.384	.389	.424	.430	.403	.559	.552	.549	.499	.549	.546	.539	.535	.483

All coefficients significantly different from zero at the 0.05 level.
Conventional tests underlined.

Test Code:

1 - California Test of Mental Maturity Elementary Language Gr. 6
2 - California Test of Mental Maturity Elementary Non-Language Gr. 6
3 - Laycock Mental Ability Test
4 - California Achievement Test Reading
5 - California Achievement Test Arithmetic
6 - California Achievement Test Language
7 - Raven's Standard Progressive Matrices
8 - Cattell "Culture-Free" Test of g - I.P.A.T.
12 - Lorge-Thorndike Non-Verbal
13 - California Test of Mental Maturity Elementary Language Gr. 7
14 - California Test of Mental Maturity Elementary Non-Language Gr. 7

TABLE XV

DIFFERENCES BETWEEN PREDICTION COEFFICIENTS OF CONVENTIONAL INTELLIGENCE TESTS AND CULTURE-REDUCED INTELLIGENCE TESTS IN GRADES 6 AND 7 IN THEIR ABILITY TO PREDICT GRADE 9 TOTAL, SCIENCE, MATHEMATICS, SOCIAL STUDIES, AND LITERATURE-LANGUAGE ACHIEVEMENT FOR THE TOTAL GRADE 6-7 SAMPLE SHOWN USING DIFFERENCES IN FISHER'S Z SCORES

N = 237 Decimal points omitted

Culture-Reduced Ability - Z_{r2}

Z_{r1} Conv. Ability	Gr. 9 Science				Gr. 9 Math.				Gr. 9 Soc. St.				Gr. 9 Lit.-Lang.			
	2	7	8	12	2	7	8	12	2	7	8	12	2	7	8	12
1	129*	069	012	069	073	-017	-031	-031	272***	214**	148*	159**	385***	318***	248***	165**
3	171**	111	054	111	079	-011	-035	-035	272***	214**	148*	159**	398***	331***	261***	178**
13	208**	148*	091	148*	126*	036	012	012	377***	319***	253***	264***	398***	331***	261***	178**

Culture-Reduced Ability - Z_{r2}

Z_{r1} Conv. Ability	Gr. 9 Total			
	2	7	8	12
1	198**	222***	166**	160**
3	352***	276***	220***	214**
13	352***	276***	220***	214**

	Gr. 9 Total				
	7,8	2,7,8	7,8,12	7,8,14	7,8,12,14
1,3	227***	221***	179**	203**	173**
3,13	249***	243***	201**	225***	195**

+ve Z_1-Z_2 indicates pred. coef. conv. > cult.-reduced; -ve Z_1-Z_2 indicates pred. coef. for cult.-reduced > for conv.

0.01 significance: $Zr_1 - Zr_2 \geqslant 0.217$ - ***;

0.05 significance: $0.217 > Zr_1 - Zr_2 \geqslant 0.153$ - **;

0.10 significance: $0.153 > Zr_1 - Zr_2 \geqslant 0.118$ - *.

Test Code:

1 - California Test of Mental Maturity Elementary Language Gr. 6
2 - California Test of Mental Maturity Elementary Non-Language Gr. 6
3 - Laycock Mental Ability Test
7 - Raven's Standard Progressive Matrices
8 - Cattell "Culture-Free" Test of g - I.P.A.T.
12 - Lorge-Thorndike Non-Verbal
13 - California Test of Mental Maturity Elementary Language Gr. 7
14 - California Test of Mental Maturity Elementary Non-Language Gr. 7

between the two types of tests in predicting Grade 9 Mathematics was indicated. It appeared that when the criterion was not very culture-loaded, a predictor of the culture-reduced type was at least as effective as a conventional predictor. A trend suggesting that culture-reduced tests may even be better for predicting Grade 9 Mathematics than conventional tests, showed up in the analysis.

The Different Socio-Economic Groups. When considering the various socio-economic Groups, Table XVI showed that the conventional tests were most frequently significantly better for the Upper Group and for the more verbal educational criteria such as Grade 9 Total, Social Studies, and Literature-Language achievement. There again, it must be remembered, that the coefficients for the Lower Group were initially low thus making it somewhat difficult to obtain statistically significant increases with only 79 cases. The results presented a trend indicating that the culture-reduced tests may be more effective predictors for all the Groups for predicting Grade 9 Science and Mathematics. Since the tendency with the various tests was somewhat the same for all Groups it was safe to conclude that the criterion, under the present treatment in the schools, was a significant factor in determining the type of predictor to be used. Of course there was the basic difference in predictability between pupils from the different socio-economic Groups regardless of what predictor was used and what the criterion was.

Some of these basic differences in predictability among the various Groups for particular predictors should be discussed.

TABLE XVI

DIFFERENCES BETWEEN PREDICTION COEFFICIENTS OF CONVENTIONAL INTELLIGENCE TESTS AND CULTURE-REDUCED INTELLIGENCE TESTS IN GRADES 6 AND 7 IN THEIR ABILITY TO PREDICT GRADE 9 TOTAL, SCIENCE, MATHEMATICS, SOCIAL STUDIES, AND LITERATURE-LANGUAGE ACHIEVEMENT FOR THE THREE SOCIO-ECONOMIC GROUPS SHOWN USING DIFFERENCES IN FISHER'S Z SCORES

N = 79 Decimal points omitted

Culture-Reduced Ability - Zr_2

Conventional Ability Zr_1		Upper S-E Group				Middle S-E Group				Lower S-E Group			
		2	7	8	12	2	7	8	12	2	7	8	12
Gr.9 Total	1	304**	110	227*	193	200	217	032	056	240*	184	158	132
	3	427***	233*	350**	316**	301**	318**	133	157	217*	161	135	109
	13	283**	089	206	172	316**	333**	148	172	299**	243*	217*	191
Gr.9 Sci.	1	063	-060	068	057	104	148	-036	076	098	-016	-070	010
	3	226*	103	231*	220*	080	124	-060	052	114	000	-054	026
	13	087	-036	092	081	210*	254*	070	182	201	087	033	113
Gr.9 Math.	1	006	-240*	-059	-159	-017	067	-101	-077	098	-069	-047	-010
	3	029	-217*	-036	-136	006	090	-078	-054	087	-080	-058	-021
	13	089	-157	024	-076	042	126	-042	-018	124	-043	-021	016
Gr.9 Soc.St.	1	409***	194	316**	377**	132	163	-017	-050	162	142	115	126
	3	297**	082	204	265*	193	224*	044	011	179	159	132	143
	13	439***	224*	346**	407***	294**	325**	145	012	262*	242*	215*	226*
Gr. 9 Lit.-Lang.	1	563***	354**	402***	336**	173	188	328**	-012	312**	322**	332**	216*
	3	423***	214*	262*	196	351**	366**	206	166	246*	256*	264*	150
	13	519***	310**	358**	292**	280**	295**	135	095	257*	267*	277**	161

+ ve $Zr_1 - Zr_2$ indicates that pred. coef. conv. > culture-reduced

- ve $Zr_1 - Zr_2$ indicates that pred. coef. culture-reduced > conv.

0.01 sig. ($Zr_1 - Zr_2 \geqslant 0.385$) - ***; 0.05 sig. ($0.385 > Zr_1 - Zr_2 \geqslant 0.269$) - **; 0.10 sig. ($0.269 > Zr_1 - Zr_2 \geqslant 0.209$) - *.

Test Code:

1 - California Test of Mental Maturity Elementary Lang. Gr. 6
2 - California Test of Mental Maturity Elementary Non-Lang. Gr. 6
3 - Laycock Mental Ability Test
7 - Raven's Standard Progressive Matrices
8 - Cattell "Culture-Free" Test of g - I.P.A.T.
12 - Lorge-Thorndike Non-Verbal
13 - California Test of Mental Maturity Elementary Non-Language Gr. 7

In predicting Grade 9 Total achievement only two tests predicted the Upper Group significantly better at the 0.05 level than the Lower Group. The two tests, as shown in Table XVII, were the Laycock and the RPM. The RPM predicted the Upper Group significantly higher at the 0.10, 0.05, or 0.01 levels for all five Grade 9 achievement scores. This is in accordance with some Hypothesis 1 findings which indicated that the RPM test increased the prediction coefficient more for the Upper Group than for the Lower one. Likewise, in agreement with some of the previous findings, the I.P.A.T. test was at no time, except for the Grade 9 Literature-Language, a significantly better predictor for the Upper Group. In summary, it seemed that when predicting highly educational and verbal material such as Grade 9 Literature-Language the results showed that all tests whether conventional or culture-reduced predicted the Upper Group significantly better. The differences for the culture-reduced tests might be interpreted in the following way. These culture-reduced tests at Grades 6 and 7 might have measured the Lower Group's general potential ability accurately. However, if in the intervening time no special adaptive treatment was given to these pupils, their performance on the educationally loaded Grade 9 tests was probably well below and different from their original culture-reduced prediction measurements. This would result in low correlation coefficients. The performance of the Upper Group was probably likewise accurately estimated at Grades 6 and 7 by the culture-reduced tests since these tests do not bias for or against the Upper Group. At Grade 9, because this Group is normally well equipped to handle educationally loaded tests,

TABLE XVII

DIFFERENCES BETWEEN PREDICTION COEFFICIENTS FOR THE SAME INTELLIGENCE TESTS IN GRADES 6 AND 7 FOR THE UPPER SOCIO-ECONOMIC GROUP AND THE LOWER SOCIO-ECONOMIC GROUP IN THEIR ABILITY TO PREDICT GRADE 9 TOTAL, SCIENCE, MATHEMATICS, SOCIAL STUDIES, AND LITERATURE-LANGUAGE ACHIEVEMENT SHOWN USING DIFFERENCES IN FISHER'S Z SCORES

N = 79 — Decimal points omitted

Zr_1 Gr. 9 Achievement	Conventional Ability Tests			Zr_2 Culture-Reduced Ability Tests			
	CTMM Lang. Gr.6	Laycock	CTMM Lang. Gr.7	CTMM Non-L. Gr.6	Raven's St. Prog. Mat.	Cattell I.P.A.T.	Lorge-Th. N-V
Total	199	345**	119	135	273**	130	138
Science	166	286**	087	201	210*	028	119
Math.	147	181	204	129	318**	159	301**
Soc. St.	288**	159	218*	041	236*	087	037
Lit.-Lang.	465***	391***	476***	214*	433***	395***	274**

Zr_1 = Z for Upper Group coefficient

Zr_2 = Z for Lower Group coefficient

+ve $Zr_1 - Zr_2$ indicates that pred. coef. for Upper Group > Lower Group

0.01 significance
$Zr_1 - Zr_2 \geqslant 0.385$ - ***;

0.05 significance
$0.385 > Zr_1 - Zr_2 \geqslant 0.269$ - **;

0.10 significance
$0.269 > Zr_1 - Zr_2 \geqslant 0.209$ - *.

the Upper Group may have performed on verbal tasks at a level relative to their present potential ability. This would yield reasonably high correlation coefficients, resulting in significant differences between the prediction coefficients for the Upper and for the Lower Groups.

The conventional test superiority for the Upper Group over the Lower Group appeared usually when the criterion was of a more verbal or educational nature. There were no significant differences between the multiple R's of the Groups for predicting Grade 9 Mathematics. An explanation for the conventional test difference between the two Groups is proposed here. The conventional tests in Grades 6 and 7 and the achievement tests in Grade 9, especially the verbally and educationally loaded ones, both measured the performance of the Upper Group more effectively. This is expressed by a fairly high correlation coefficient. The Lower Group was probably inaccurately measured by the Grades 6 and 7 conventional ability tests. During the prediction interval some of the members of this Group may have improved their verbal facility through the school environment and, consequently, performed better on the Grade 9 achievement tests than they did on the Grades 6 and 7 ability tests. This would result in low correlation coefficients which would in turn cause the coefficients for the Upper Group to be significantly higher than for the Lower Group. In summary, we could again say, that regardless of the types of ability test predictors used, the Lower Group cannot be predicted as effectively as the Upper Group. The smallest difference in predictability appeared when the criterion was

Grade 9 Mathematics, which of course is not as verbal as the Grade 9 Total or the other three Grade 9 achievement tests.

Ability and Achievement Tests as Predictors

Hypothesis 2 also stated that achievement tests will predict future achievement over short periods more effectively than will conventional or culture-reduced ability tests. In almost all cases the results indicated a trend showing that the conventional ability tests are superior (shown as negative values in Tables XVIII and XIX) to the individual California Reading, Arithmetic, or Language Achievement tests in predicting Grade 9 Total achievement as well as Science, Mathematics, Social Studies, and Literature-Language. In fact the Laycock and the CTMM Lang. were significantly better at the 0.05 level than the California Arithmetic in predicting Grade 9 Total performance. It was however found, that the achievement tests were significantly better predictors than the culture-reduced tests, especially when the criterion was more verbally loaded. When predicting achievement such as Grade 9 Science and Mathematics, the culture-reduced tests showed a non-significant tendency (not a statistically significant trend) to be better predictors than the achievement tests even where the California Achievement Arithmetic test was used to predict Grade 9 Mathematics. For the particular achievement predictors used there were no cases of the achievement tests being significantly better at the 0.05 or 0.01 levels than conventional ability tests. The California Achievement tests did, however, appear to be significantly better predictors at the 0.10, 0.05, or 0.01 levels of Grade 9 Total,

TABLE XVIII

DIFFERENCES BETWEEN PREDICTION COEFFICIENTS OF INTELLIGENCE TESTS AND ACHIEVEMENT TESTS IN GRADES 6 AND 7 IN THEIR ABILITY TO PREDICT GRADE 9 TOTAL, SCIENCE, MATHEMATICS, SOCIAL STUDIES, AND LITERATURE-LANGUAGE ACHIEVEMENT FOR THE WHOLE GRADE 6-7 SAMPLE SHOWN USING DIFFERENCES IN FISHER'S Z SCORES

N = 237 Decimal points omitted

Zr_1 California Achievement		Zr_2 Conventional Ability			Zr_2 Culture-Reduced Ability				Gr. 9 Achievement
		CTMM Lang. Gr.6	Laycock	CTMM Lang. Gr.7	CTMM Non-L. Gr.6	Raven's Mat.	Cattell I.P.A.T.	Lorge-Th. N-V.	
Total	Rdg.	033	-021	-021	331***	255***	199**	193**	
	Arith.	-107	-161**	-161**	191**	115	059	053	
	Lang.	-065	-119*	-119*	233***	157**	101	095	
Science	Rdg.	-023	-065	-102	106	046	-005	046	
	Arith.	-069	-111	-148*	060	000	-051	000	
	Lang.	-151*	-193**	-230***	-022	-082	-133*	-082	
Math.	Rdg.	059	053	006	132*	042	018	018	
	Arith.	029	023	-024	102	012	-012	-012	
	Lang.	-051	-057	-104	022	-068	-092	-092	
Soc. St.	Rdg.	119*	119*	014	391***	333***	267***	278***	
	Arith.	-019	-019	-104	253***	195**	129*	140*	
	Lang.	-097	-097	-202**	175**	117	051	062	
Lit.-Lang.	Rdg.	034	021	021	419***	352***	282***	199**	
	Arith.	-088	-101	-101	297***	230***	160**	077	
	Lang.	134*	121*	121*	519***	452***	382***	299***	

+ve $Zr_1 - Zr_2$ indicates that pred. coef. achievement tests > ability tests

-ve $Zr_1 - Zr_2$ indicates that pred. coef. ability tests > achievement tests

0.01 significance	0.05 significance	0.10 significance
$Zr_1 - Zr_2 \geqslant 0.217$ - ***;	$0.217 > Zr_1 - Zr_2 \geqslant 0.153$ - **;	$0.153 > Zr_1 - Zr_2 \geqslant 0.118$ - *.

TABLE XIX

DIFFERENCES BETWEEN PREDICTION COEFFICIENTS OF INTELLIGENCE TESTS AND ACHIEVEMENT TESTS IN GRADES 6 AND 7 IN THEIR ABILITY TO PREDICT GRADE 9 TOTAL ACHIEVEMENT FOR THE WHOLE GRADE 6-7 SAMPLE SHOWN USING DIFFERENCES IN FISHER'S Z SCORES

N = 237 Decimal points omitted

		Zr_2											
		Conventional		Culture-Reduced					Conventional + Culture-Reduced				
		1,3	3,13	7,8	2,7,8	7,8,12	7,8,14	7,8, 12,14	1,2,3	7,8, 13,14	7,8,13	1,2	12, 13,14
Zr_1 Achievement Tests	4,5,6	-022	-044	205**	199**	157**	181**	151*	-022	-007	126*	062	-007
	4,5	-029	-051	198**	192**	150*	174**	144*	-029	-014	119*	053	-014
	4,6	-036	-058	191**	185**	143*	167**	137*	-034	-021	112	048	-021
	5,6	-103	-125*	124*	118*	076	100	070	-103	-088	045	-019	-088

+ve $Zr_1 - Zr_2$ indicates that pred. coef. for achievement tests > intelligence tests

-ve $Zr_1 - Zr_2$ indicates that pred. coef. for intelligence tests > achievement tests

0.01 significance	0.05 significance	0.10 significance
$Zr_1 - Zr_2 \geqslant 0.217$ - ***	$0.217 > Zr_1 - Zr_2 \geqslant 0.153$ - **	$0.153 > Zr_1 - Zr_2 \geqslant 0.118$ - *

Test Code:

1 - California Test of Mental Maturity Elementary Language Gr. 6
2 - California Test of Mental Maturity Elementary Non-Language Gr. 6
3 - Laycock Mental Ability Test
4 - California Achievement Test Reading
5 - California Achievement Test Arithmetic
6 - California Achievement Test Language
7 - Raven's Standard Progressive Matrices
8 - Cattell "Culture-Free" Test of g - I.P.A.T.
12 - Lorge-Thorndike Non-Verbal
13 - California Test of Mental Maturity Elementary Language Gr. 7
14 - California Test of Mental Maturity Elementary Non-Language Gr. 7

Social Studies, and Literature-Language achievement than culture-reduced tests. In examining Table XIX we find, for the whole Grade 6-7 Sample, that when the multiple correlation coefficients between groups of achievement test predictors and Grade 9 Total achievement and the multiple correlation coefficients between combinations of conventional and culture-reduced ability test predictors and Grade 9 Total achievement were compared, the results were similar to the comparisons between zero order coefficients in Table XVIII. The achievement tests were significantly better predictors at the 0.10, 0.05, or 0.01 levels than the culture-reduced tests, whereas the conventional ability tests showed a tendency (significant only at 0.10 level in one case) to be better predictors than the achievement tests.

It would appear that the particular achievement tests used in this study may be too narrow or too specific to predict performance on such tests as the Grade 9 Departmentals. Even the California Arithmetic is less effective (not significantly) in predicting Grade 9 Mathematics than certain ability tests. We may conclude that the tasks presented by the Grade 9 Total tests are probably more like those presented by the conventional ability tests than by the individual California Achievement tests. However, the culture-reduced tests are probably more unlike the Grade 9 Total, Social Studies, and Literature-Language achievement tests than the California Achievement predictors. Even if the achievement test predictors were quite similar to the criteria there is still the length of the prediction interval to consider. It is not possible to assess in this study whether three years is too

long an interval for an achievement test to predict future achievement. It could then be that the California Achievement tests are valid predictors; however, the time interval may have been too long.

Summary

Conventional ability tests, used over the two and three-year periods, were significantly more effective at 0.10, 0.05, or 0.01 levels than culture-reduced ability tests in predicting Grade 9 achievement, especially when this achievement was of the highly verbally loaded type. In predicting achievement such as Grade 9 Mathematics there was a tendency (not statistically significant) for the culture-reduced predictors to be superior to the conventional ability tests. The conventional ability tests were also more frequently found to be significantly better predictors than culture-reduced ability tests for the Upper Group than for the Lower Group. While comparing the same tests for the Upper and Lower Groups, it was found that when predicting to the more verbal-educational criteria both the conventional and the culture-reduced ability tests predicted the Upper Group significantly better than the Lower Group. There were only a few cases, as shown in Table XVII, where any of the ability tests were significantly better for the Upper than for the Lower Group in predicting Grade 9 Mathematics and Grade 9 Science.

In comparing the predictive ability of achievement tests to that of ability tests over a three-year interval it was found that the achievement tests were only significantly better at 0.10, 0.05, or 0.01 levels than the culture-reduced ability tests and

then, only while predicting such Grade 9 performance as Total, Social Studies, and Literature-Language. When the criteria were of a less verbal nature, such as Grade 9 Science and Mathematics, even the culture-reduced ability tests showed a trend suggesting better predictive ability than the California Achievement tests. For all criteria, in almost all cases, the conventional ability tests showed a tendency (a non-significant one except in some situations for the Grade 9 Total) to be better predictors than the achievement tests.

In a number of situations the results for this hypothesis could be somewhat more conclusive than the present statistical tests show since the calculations for determining differences between correlation coefficients, especially the zero order ones, were made on the basis of non-correlated variables. This was done because in many of these cases the intercorrelations for the variables were not available.

CHAPTER VIII

CHANGES IN ACHIEVEMENT BETWEEN TESTING OCCASIONS FOR PUPILS OF DIFFERENT SOCIO-ECONOMIC LEVELS

Achievement Changes Over a Six-Year Period

It is likely that the school environment in our educational system is favorable for the academic and scholastic development of the upper socio-economic status students but not especially so for the pupils from the lower socio-economic levels. Hypothesis 3 stated that the achievement for the Upper Group of the Grade 3 Sample will be higher and for the Lower Group will be lower, relative to the total Sample at Grade 9, than the achievement for the corresponding Groups in Grade 3. At Grade 3, measures for the California Achievement Arithmetic, Language, and Total were obtained and compared to Grade 9 Mathematics, Literature-Language, and Total scores, respectively. Although the test scores compared at the different grade levels were not from comparable forms of the same test, the tests did constitute, in general, the curriculum requirements for the particular grades and therefore, in this practical sense, warranted this comparison.

Tables XX and XXI indicated significant decreases at the 0.05 level for the Language score and the Total score as the Lower Group passed from Grade 3 to Grade 9. The Arithmetic-Mathematics score, however, did not decrease enough to attain the 0.05 level of significance. The results for the Upper Group likewise supported the hypothesis to a considerable extent. This Group showed an increase significant at the 0.01 level for the Language score and

TABLE XX

MEANS AND STANDARD DEVIATIONS FOR THE CALIFORNIA ARITHMETIC, LANGUAGE, AND TOTAL ACHIEVEMENT TESTS AT GRADE 3 COMPARED TO THOSE OF MATHEMATICS, LITERATURE-LANGUAGE, AND TOTAL ACHIEVEMENT RESPECTIVELY AT GRADE 9 FOR THE LOWER SOCIO-ECONOMIC GROUP OF THE GRADE 3 SAMPLE

TOTAL GRADE 3 SAMPLE N = 207 WAS T-SCORED

	Lower Socio-Econ. Group						
	Grade 3 N = 69	Grade 9 N = 69	Mean Difference	t values	Significance	F values	Significance
r = 0.353	Calif. Arith.	Mathematics					
Mean	49.42	47.38	2.04	1.45	N.S. at 0.05	--	--
Standard Deviation	10.44	10.23	--	--	--	1.04	N.S. at 0.05
r = 0.383	Calif. Lang.	Lit.-Lang.					
Mean	49.92	47.54	2.38	1.85	Sig. at 0.05 N.S. at 0.01	--	--
Standard Deviation	9.38	9.95	--	--	--	1.12	N.S. at 0.05
r = 0.419	Calif. Total	Total					
Mean	49.26	46.95	2.31	1.72	Sig. at 0.05 N.S. at 0.01	--	--
Standard Deviation	10.45	10.22	--	--	--	1.05	N.S. at 0.05

Significance levels based on one-tailed tests.

TABLE XXI

MEANS AND STANDARD DEVIATIONS FOR THE CALIFORNIA ARITHMETIC, LANGUAGE, AND TOTAL ACHIEVEMENT TESTS AT GRADE 3 COMPARED TO THOSE OF MATHEMATICS, LITERATURE-LANGUAGE, AND TOTAL ACHIEVEMENT RESPECTIVELY AT GRADE 9 FOR THE UPPER SOCIO-ECONOMIC GROUP OF THE GRADE 3 SAMPLE

TOTAL GRADE 3 SAMPLE N = 207 WAS T-SCORED

	Upper Socio-Econ. Group						
	Grade 3 N = 69	Grade 9 N = 69	Mean Difference	t values	Significance	F values	Significance
r = 0.354	Calif. Arith.	Mathematics					
Mean	52.16	53.04	0.88	0.76	N.S. at 0.05	--	--
Standard Deviation	9.21	7.47	--	--	--	1.52	Sig. at 0.05 N.S. at 0.01
r = 0.603	Calif. Lang.	Lit.-Lang.					
Mean	50.39	53.45	3.06	3.03	Sig. at 0.01	--	--
Standard Deviation	10.09	8.18	--	--	--	1.52	Sig. at 0.05 N.S. at 0.01
r = 0.507	Calif. Total	Total					
Mean	51.81	53.68	1.87	1.78	Sig. at 0.05 N.S. at 0.01	--	--
Standard Deviation	9.06	8.59	--	--	--	1.11	N.S. at 0.05

Cochran and Cox test used in Lit.-Lang. The significant difference in means is real and not due to a difference in variability (test showed that $t > t'$).

Significance levels based on one-tailed tests.

at the 0.05 level for the Total score. The Cochran and Cox test was used for the Language comparison to show that $t > t'$ thus indicating that the difference in means was real and not due to the significant difference in variability indicated in this comparison. Again, just as the Lower Group did not decrease significantly, the Upper Group did not increase enough in the Grade 9 Mathematics score over the Grade 3 Arithmetic to attain a 0.05 level of significance.

Explanation of Results. The results supported the thesis that facility in tasks which are more general (ones which are less dependent on books or less affected by environmental influences) is more likely to remain constant over the years than facility in more educational and verbal tasks. Arithmetic and Mathematics can be considered to be one of the former and therefore no significant increase and decrease for the Upper and Lower Groups, respectively, was obtained. The fact that the Language comparison showed a greater increase and decrease than did the Total score comparison further supported this proposition.

Summary

In terms of the results in this part of the study we can expect children from low socio-economic status homes to get progressively poorer in achievement in relation to the whole socio-economically heterogeneous group as they pass through school. The achievement of upper socio-economic status students progressively became higher compared to the whole Sample. This effect was most pronounced for achievement in areas which were more

verbal and more influenced by the schooling process. Achievement in subjects such as mathematics showed least change for either the upper or lower class students over the years. Such results would suggest that the school environment, as one of the influences affecting the development of children, may be well suited to the academic growth of the verbal nature for the upper socio-economic level students but does not provide enough appropriate treatment for the development of the lower socio-economic level pupils in this same area.

CHAPTER IX

THE EFFECT OF THE SOCIO-ECONOMIC SCORE ON THE PREDICTIVE VALIDITY OF ABILITY AND ACHIEVEMENT TESTS

It was postulated that the performance in academic and scholastic tasks in our schools is somewhat related to the socio-economic status level of the student. In view of this, Hypothesis 4 was formulated stating that the addition of a socio-economic status score to ability or achievement test scores at Grades 6 and 7 will enable these ability and achievement tests to predict Grade 9 achievement more accurately. When the analysis of the data for the whole Grade 6-7 Sample in Table XXIII was reviewed, it was found that the Socio-Economic Score (S.E.S.) increased the predictive validity significantly at the 0.05 or 0.01 levels in all the cases. The largest increases occurred when the S.E.S. were added to the culture-reduced tests. All these increases were at the 0.01 level of significance except the one for the Lorge-Thonrdike which was at about the 0.02 level of significance. Since the S.E.S. contributed most to the culture-reduced tests and, remembering that the criterion is culture-loaded and academic in nature, one could safely say that the S.E.S. is a type of culture-loaded measure which, in our educational system, would contribute substantially in predicting future academic achievement. Table XXIV showed that there was much more relationship between the S.E.S. and conventional ability tests than there was between the S.E.S. and tests which were less educationally or culturally loaded. The correlation coefficients for the CTMM Lang., Laycock, Grade 9 Literature-Language, and Grade 9 Social

TABLE XXII

CORRELATION COEFFICIENTS BETWEEN GRADE 9 TOTAL ACHIEVEMENT AND VARIOUS GRADE 6 AND 7 INTELLIGENCE AND ACHIEVEMENT TESTS WITHOUT AND WITH THE SOCIO-ECONOMIC SCORE AS AN ADDITIONAL INDEPENDENT PREDICTOR VARIABLE FOR THE WHOLE GRADE 6-7 SAMPLE AND FOR THE THREE SOCIO-ECONOMIC GROUPS

Decimal points are omitted

		Total Sample N = 237		Upper Group N = 79		Middle Group N = 79		Lower Group N = 79	
		Without SES	With SES	Without SES	With SES	Without SES	With SES	Without SES	With SES
Conventional Intelligence Tests	CTMM Lang. Gr.6	496	517	517	524	471	472	357	357
	Laycock	534	553	601	602	547	547	335	338
	CTMM Lang. Gr.7	534	546	502	505	557	559	404	405
	CTMM Lang. Gr.6 + Laycock	559	571	619	628	554	557	368	377
Culture-Reduced Intelligence Tests	CTMM Non-L. Gr.6	242	374	259	304	301	305	129	131
	Raven's Mat.	312	399	429	430	284	285	187	190
	Cattell I.P.A.T.	358	423	331	337	446	446	208	214
	Lorge-Th. Fig. Cl.	219	353	133	168	312	315	161	175
	Lorge-Th. Num. Ser.	308	345	363	373	252	252	222	226
	Lorge-Th. Fig. An.	313	392	323	326	385	386	174	179
	Lorge-Th. N-V Tot.	366	425	358	359	423	423	235	240
	CTMM Non-L. Gr.7	315	410	382	386	339	340	196	203
	Raven's + Cattell	384	440						
	Raven's + Cattell + Lorge-Th. N-V Tot.	424	465						
Conventional + Culture-Reduced	CTMM Lang.+ Non-L.Gr.6	499	521						
	CTMM Lang.+ Non-L. Gr.6 + Laycock	559	571						
	Lorge-Th.N-V Tot. + CTMM Lang.+ Non-L. Gr.7	549	560						
Achievement Tests	Cal. Ach. Rdg. + Arith. + Lang.	546	565						
	Cal. Ach. Rdg. + Arith.	539	558						
	Cal. Ach. Rdg. + Lang.	535	545						
	Cal. Ach. Arith. + Lang.	483	522						

Coefficients not significantly different from zero at the 0.05 level are underlined.

TABLE XXIII

F VALUES SHOWING INCREASES IN PREDICTIVE CORRELATION COEFFICIENTS BROUGHT ABOUT BY INTRODUCING THE SOCIO-ECONOMIC SCORE TO VARIOUS INTELLIGENCE AND ACHIEVEMENT TESTS IN GRADES 6 AND 7 TO PREDICT GRADE 9 TOTAL ACHIEVEMENT FOR THE TOTAL GRADE 6-7 SAMPLE AND FOR THE THREE SOCIO-ECONOMIC GROUPS

		Total Sample N = 237	Upper Group N = 79	Middle Group N = 79	Lower Group N = 79
Conventional Intelligence Tests	CTMM Lang. Gr. 6	6.79***	0.76	0.15	0.00
	Laycock	6.96***	0.14	0.00	0.17
	CTMM Lang. Gr. 7	4.30**	0.31	0.25	0.12
	CTMM Lang. Gr. 6 + Laycock	4.71***	1.41	0.25	0.59
Culture-Reduced Intelligence Tests	CTMM Non-L. Gr. 6	22.10***	1.97	0.20	0.04
	Raven's Mat.	17.21***	0.13	0.07	0.09
	Cattell I.P.A.T.	14.47***	0.34	0.00	0.20
	Lorge-Th. Fig. Cl.	20.49***	0.82	0.16	0.36
	Lorge-Th. Num. Ser.	6.42**	0.65	0.00	0.14
	Lorge-Th. Fig. An.	15.40***	0.17	0.12	0.08
	Lorge-Th. N-V Tot.	13.31***	0.10	0.00	0.18
	CTMM Non-L. Gr. 7	19.37***	0.27	0.09	0.22
	Raven's Mat. + Cattell	13.39***			
	Raven's + Cattell + Lorge-Th. N-V Tot.	10.88***			
Conventional + Culture-Reduced	CTMM Lang. + Non-L. Gr. 6	7.21***			
	CTMM Lang. + Non-L. Gr. 6 + Laycock	4.71***			
	Lorge-Th. N-V Tot. + CTMM Lang. + Non-L.Gr.7	4.16***			
Achievement Tests	Cal. Ach. Rdg. + Arith. + Lang.	7.26***			
	Cal. Ach. Rdg. + Arith.	7.08***			
	Cal. Ach. Rdg. + Lang.	3.60**			
	Cal. Ach. Arith. + Lang.	12.60***			

	0.01 Sig.	0.05 Sig.
$df_{1,76}$	$\infty \geq F \geq 6.98$ - ***	$6.98 > F \geq 3.97$ - **
$df_{2,75}$	$\infty \geq F \geq 4.90$ - ***	$4.90 > F \geq 3.12$ - **
$df_{1,234}$	$\infty \geq F \geq 6.76$ - ***	$6.76 > F \geq 3.89$ - **
$df_{2,233}$	$\infty \geq F \geq 4.71$ - ***	$4.71 > F \geq 3.04$ - **
$df_{3,232}$	$\infty \geq F \geq 3.88$ - ***	$3.88 > F \geq 2.65$ - **

TABLE XXIV

CORRELATION COEFFICIENTS BETWEEN THE SOCIO-ECONOMIC SCORES AND ALL THE GRADES 6, 7, AND 9 INTELLIGENCE AND ACHIEVEMENT TEST SCORES FOR THE WHOLE GRADE 6-7 SAMPLE

N = 237

	Socio-Economic Score
California Test of Mental Maturity Language Grade 6	0.327
California Test of Mental Maturity Non-Language Grade 6	0.067
Laycock Mental Ability Test Grade 6	0.311
California Achievement - Reading Grade 6	0.316
California Achievement - Arithmetic Grade 6	0.169
California Achievement - Language Grade 6	0.220
Raven's Standard Progressive Matrices Grade 7	0.183
Cattell I.P.A.T. "Culture-Free" Test of g Grade 7	0.230
Lorge-Thorndike Figure Classification Grade 7	0.121
Lorge-Thorndike Number Series Grade 7	0.166
Lorge-Thorndike Figure Analogies Grade 7	0.227
Lorge-Thorndike Non-Verbal Total Grade 7	0.250
California Test of Mental Maturity Language Grade 7	0.361
California Test of Mental Maturity Non-Language Grade 7	0.130
Grade 9 Departmental Literature-Language	0.366
Grade 9 Departmental Social Studies	0.364
Grade 9 Departmental Mathematics	0.245
Grade 9 Departmental Science	0.247
Grade 9 Departmental Total	0.301

Coefficients not significantly different from zero at:
0.01 level for $-0.181 < r < +0.181$ (double underline)
0.05 level for $-0.138 < r < +0.138$ (single underline)

Studies ranged from 0.31 to 0.37 whereas a large number of the coefficients for the culture-reduced tests were not even significantly different from zero at the 0.05 level. It should also be noticed in comparing the coefficients in Table XXII and Table XXIV that the S.E.S. is in many cases as good a predictor of Grade 9 achievement as are the culture-reduced tests. All these results would imply that the S.E.S. will contribute less to the conventional ability tests in predicting Grade 9 Total achievement than they will to the more culture-reduced tests.

Diverting somewhat from the main idea of Hypothesis 4, F scores for the tests shown in Table XXIII were obtained for the three socio-economic Groups. None of the increases even approached a significance of 0.05. No generalizations can be made about any of the Groups except that the increases for all the Groups were small. This situation can be attributed in part to the reduced range in scores and the reduction in the number of cases. We could conclude that for this particular study the S.E.S. increased the predictive ability significantly for the whole Grade 6-7 Sample (which includes the full range of socio-economic levels) but not for the individual socio-economic Groups.

Summary

Socio-Economic Scores, added to intelligence and achievement tests, increased the ability of these tests to predict future achievement. These S.E.S. seemed to contribute most to the predictive ability of culture-reduced ability tests. It was felt that the S.E.S. might be considered to be a culture-loaded measure

which would be useful for combining with culture-reduced intelligence tests in predicting performance on such culturally loaded tests as the Grade 9 Total. The conventional intelligence tests did not benefit as much from the S.E.S. because these tests themselves are educationally loaded. In considering the effect of the S.E.S. for the individual socio-economic Groups it was found that, probably because of the reduced range and the decrease in the number of cases, the increases in predictive coefficients were far from being significant at the 0.05 level.

CHAPTER X

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The purpose of this longitudinal study was to investigate the effectiveness of different ability and achievement tests in predicting achievement in later years for pupils from different socio-economic status levels. Also, differences in the effects of environmental influences on the various socio-economic status groups, expressed in terms of achievement scores, were examined. The use of the pupil's socio-economic status level as an independent variable in prediction of future school achievement was also taken into account in this study. The emphasis in this study has been on the predictive validity of the various tests. The reader may acquire information on the effectiveness of these tests in measuring certain constructs for the pupils from various socio-economic levels from Elley's (1961) study. His sample consisted of the 271 cases from which the two Samples for the present writer's study were drawn. The conclusions expressed by Elley regarding the validities of the tests would apply to this study.

The tests used in the study are ones which are fairly well known in the field of educational psychology and have either been extensively or occasionally used by the Edmonton Public School system. Although the Grade 9 Departmentals are different tests every year they are still representative of the Grade 9 curriculum requirements. All the scores for this study were examined for normality. The scores for the correlational portions of the experiment were used in the raw form whereas the ones used for

comparisons of means and standard deviations were transformed to T-scores.

The two Samples drawn from Elley's 271 cases were the Grade 3 Sample consisting of 207 cases and the Grade 6-7 Sample of 237 cases. The two Samples were checked for sample bias. It was found that both Samples were representative of the total Edmonton public school population and that there were no sex differences in terms of the variables compared. The two Samples were each divided into three socio-economic groups; the Upper, Middle, and Lower Groups. Various Samples and Groups were then used to test the four hypotheses.

With the type of data available and the number of cases used it was not possible to apply rigorous statistical tests to all the findings. Consequently, although many of the findings from the analyzed data were presented on the basis of strict statistical tests some were also presented in terms of inferences from some trends. Distinction was made between the various bases for reporting the findings.

Experimental Findings

I. Hypothesis 1

1. (a) Correlation coefficients between Grade 3 Ability test scores and Grade 9 Total achievement scores were low for all three socio-economic Groups. For the Lower Group the coefficients for the CTMM Lang. as well as for the CTMM Lang. plus the culture-reduced tests were not significantly different from zero at the 0.05 level.

(b) The addition of the culture-reduced tests to the

conventional CTMM Lang., all given at Grade 3, did not produce significant increases in the prediction coefficients in any instances. The trend in terms of F scores in Table X indicated the Raven's Coloured Progressive Matrices scores contributed more for each Group than the CTMM Non-L. scores did.

2. (a) The correlation coefficients between the Grades 6 and 7 conventional ability test scores as well as between the conventional plus culture-reduced ability test scores and Grade 9 Total achievement were all significantly different from zero at the 0.05 level. The coefficients for the Upper Group for the Laycock and Laycock plus CTMM Lang. were significantly greater than for the Lower Group at the 0.05 or 0.01 levels, respectively (Table IX).

(b) Addition of culture-reduced intelligence tests to the Grades 6 and 7 CTMM Lang. and to the Laycock, in a number of cases, increased the ability to predict Grade 9 Total achievement at the 0.05 or 0.01 levels of significance for the Upper and Middle Groups. There were no significant increases for the Lower Group.

(c) For the Upper Group the addition of the RPM test to the conventional intelligence test at Grades 6 and 7 increased the ability to predict Grade 9 Total achievement more than the addition of any other culture-reduced test. With all four conventional intelligence test variables the increases were significant at 0.05 or 0.01.

(d) In terms of beta weights the Raven's test seemed to be an effective supplement to the conventional intelligence

tests at Grades 6 and 7 for the Upper Group in predicting Grade 9 Total achievement. However, the beta weights for this test were very low and in some cases negative for the Middle and Lower Groups.

(e) The I.P.A.T. and the L-T N-V Total tests, when added to the convertional intelligence tests at Grades 6 and 7, increased the prediction more for the Middle and Lower Groups than any other culture-reduced tests did. The increases in many cases were not significant at the 0.05 or 0.01 levels; however, the F scores indicated such a tendency.

II. Hypothesis 2

1. (a) For the total Grade 6-7 Sample it was found that in almost all the cases for predicting Grade 9 Total, Grade 9 Social Studies and Grade 9 Literature-Language achievement the conventional ability tests were significantly better predictors at the 0.05 or 0.01 levels than the culture-reduced ability tests (Table XV).

(b) There were no cases of the conventional tests being significantly better at the 0.01 level than the culture-reduced tests for predicting Grade 9 Science. For predicting Grade 9 Mathematics the trend, though not significant, indicated that the culture-reduced tests may be better predictors than conventional ability tests for this two or three-year period for the total Sample (Table XV).

(c) The conventional ability tests at Grades 6 and 7 were most frequently significantly better predictors for the Upper than for the other Groups and also for criteria

such as Grade 9 Total, Grade 9 Social Studies, and Grade 9 Literature-Language (Table XVI).

(d) In almost all cases for predicting Grade 9 Science and Mathematics the trend was for the culture-reduced tests to be better, though not significantly, than conventional ability tests for all the Groups (Table XVI).

(e) The RPM predicted significantly better at the 0.10, 0.05, or 0.01 levels for the Upper than for the Lower Group for all five Grade 9 achievement scores while the I.P.A.T. was only significantly better in predicting Grade 9 Literature-Language (Table XVII).

(f) In predicting to highly cultural criteria such as Grade 9 Literature-Language, all ability tests whether conventional or culture-reduced predicted the Upper Group significantly better than they did the Lower Group (Table XVII).

2. (a) For the three-year period with the whole Grade 6-7 Sample, a non-significant trend indicated that the conventional ability tests at Grades 6 and 7 were better predictors of Grade 9 Total as well as Science, Mathematics, Social Studies, and Literature-Language achievement than the individual Grade 6 California Achievement tests (Table XVIII).

(b) In many cases for the whole Sample the California Achievement tests at Grade 6 were significantly better predictors at the 0.10, 0.05, or 0.01 levels than the culture-reduced ability tests for predicting Grade 9 Total, Grade 9 Social Studies, and Grade 9 Literature-

Language. For predicting Grade 9 Science and Grade 9 Mathematics there was a tendency in many instances for the culture-reduced ability tests to be superior to the California Achievement Tests.

III. Hypothesis 3

1. (a) The Lower socio-economic Group's performance means relative to the total Sample for Language and Total achievement decreased significantly (at the 0.05 level) from Grade 3 to Grade 9 (Table XX).

(b) The Upper socio-economic Group's performance means relative to the total Sample for Language and Total achievement increased significantly at the 0.01 and the 0.05 levels, respectively from Grade 3 to Grade 9 (Table XXI).

(c) In the Grade 3 to Grade 9 interval the performance means relative to the total Sample in Arithmetic-Mathematics did not decrease significantly for the Lower Group nor increase significantly for the Upper Group (Tables XX and XXI).

IV. Hypothesis 4

1. (a) The addition of the Socio-Economic Scores to intelligence and achievement test scores for the whole Grade 6-7 Sample significantly increased the prediction at the 0.05 or 0.01 levels of Grade 9 Total achievement in all cases (Table XXIII).

(b) The most prominent increases in the prediction correlation coefficients produced by the inclusion of the S.E.S. were in cases where these Scores were added

to culture-reduced ability tests (Table XXIII).

(c) In considering the three individual socio-economic Groups no significant increases at the 0.05 level were produced by including the S.E.S. with the ability tests to predict Grade 9 Total achievement.

Conclusions

Although Hypotheses 2 (a), 3, and 4 have been supported by the findings in this study, Hypothesis 1 has not been upheld. The theorizing in earlier chapters implied that pupils from lower socio-economic status levels should be measured with culture-reduced ability tests to eliminate some of the cultural bias against them normally found in conventional ability tests. It was postulated that these culture-reduced tests, because they measure a more general and less educationally influenced type of ability, would give us a more accurate initial estimate of the ability of pupils from lower socio-economic status levels.

Consequently, it was considered that such tests would be of assistance in predicting future achievement especially for these pupils. However, the addition of culture-reduced ability tests to conventional ability tests seemed to increase the prediction of Grade 9 Total achievement significantly at the 0.05 or 0.01 levels for the Upper Group and occasionally at the 0.05 level for the Middle Group, but in no instances for the Lower Group. As a matter of fact, less culture-reduced tests such as the I.P.A.T. and the L-T N-V were found to add more to the prediction for the Lower Group than did more culture-reduced tests such as the RPM.

In terms of the above findings, as well as some of the findings for Hypothesis 2, the writer concludes that the nature of the treatment in our schools is such that it does not enable us to predict most types of school achievement for students from lower socio-economic status levels by using the ability tests now available. With the type of treatment, the various ability tests available (whether conventional or culture-reduced), and the criteria considered, it appears that the students from higher socio-economic levels can be predicted more accurately than students from low socio-economic levels.

The results do, however, point out that under present treatments the lower socio-economic students can be predicted more accurately with culture-reduced tests for certain types of achievement, namely less verbal ones such as Grade 9 Mathematics and in some instances Grade 9 Science. The writer concludes that under the present somewhat non-adaptive treatment described earlier, one must not just consider the type of population tested and on that basis only determine the type of predictors that should be used, but must also consider the nature of the achievement that one wishes to predict. In support of this we notice that in Table XVI there was a tendency for the culture-reduced tests to predict Grade 9 Mathematics with more accuracy than the conventional ability tests. So, since the increases in prediction resulting from the addition of culture-reduced predictors to conventional ability tests with the Lower socio-economic Group in predicting to the specific Grade 9 achievements have not been considered in this study, it may well be, that for Grade 9 achievement such as

Mathematics the culture-reduced ability tests may have increased the prediction significantly.

The findings in this study upheld Hypothesis 2 (a). In predicting Grade 9 achievement from performance on ability tests in Grades 6 and 7 we concluded that when the criterion is of a more verbal-educational nature such as Grade 9 Total, Social Studies, or Literature-Language we get the most accurate prediction for the total Grade 6-7 Sample and for the different socio-economic Groups by using conventional ability tests such as the CTMM Lang. and the Laycock. When predicting achievement such as Grade 9 Science or Mathematics for the whole Sample or for the socio-economic Groups there was a non-significant trend suggesting that tests in Grades 6 and 7 such as the RPM, the I.P.A.T., or the L-T N-V were more appropriate. With respect to the (b) section of Hypothesis 2, it appeared that achievement tests were found to be significantly better predictors of Grade 9 Total, Grade 9 Social Studies, and Grade 9 Literature-Language than the culture-reduced ability tests. However, the conventional ability tests showed a tendency, and in a few cases significance, to be superior to the California Achievement tests in predicting these Grade 9 achievement scores. When predicting performance on culture-reduced achievement tests such as Grade 9 Science and Mathematics the culture-reduced ability tests appeared to be non-significantly better for the whole Sample than the individual California Achievement tests. Here again, results would suggest that under the circumstances in the schools, the nature of the criterion as well as the type of population measured may be influential factors

in determining the most useful predictor tests. In view of the fact that the Grade 6 achievement results did not predict Grade 9 achievement as expected for Hypothesis 2 (b), the writer concludes that these individual California Achievement tests may be too specific or too narrow to be appropriate measures for predicting performance on somewhat all-encompassing achievement tests such as the Grade 9 Departmentals.

The element of time may be of consequence here. Three years may be too long a prediction interval for a specific predictor such as an individual California Achievement test, but may be quite appropriate for achievement tests which would incorporate tasks that are more representative of the Grade 9 curriculum. Part (b) of Hypothesis 2 should be verified by other studies using various prediction intervals and numerous achievement test predictors before any definite conclusions can be made.

In relating to the total Grade 6-7 Sample we could conclude from findings in Hypothesis 3 that either the school environment, the out-of-school environment, or a combination of both influence the upper socio-economic status level pupils in such a way that they become more adept through the years in performing on tasks of a more verbal and educational nature, whereas the influence on the lower socio-economic status pupils is such that they progressively decrease in facility on such tasks. Performance on tasks which are not as verbal or are not prone to change due to environmental influences does not change significantly through the years for either type of pupils. Generally, it appears that

this academically oriented environment does not make provisions for the lower class pupils to "hold their own" through the years in their ability to perform on verbal tasks.

Since our schools are verbally oriented, with values similar to those of the upper and middle socio-economic classes of people, it is logical for success at these verbal school tasks to be attained by pupils from the upper and middle socio-economic classes. Most failures at these tasks should, consequently, occur among the lower socio-economic status pupils. Studies have supported this by indicating the existence of a positive relationship between socio-economic status levels of persons and their performance on conventional verbal ability tests. Findings for Hypothesis 4 are in agreement with these studies. On this basis the writer concludes that the Socio-Economic Score is really a type of culture-loaded measure and should contribute to prediction in much the same way that a conventional ability test does. The results of this study, by showing that the addition of the S.E.S. to culture-reduced ability tests increased the prediction of Grade 9 Total achievement for the Grade 6-7 Total Sample more than the addition of the S.E.S. to the conventional verbal ability or achievement tests, support the above conclusion.

An attempt was made to investigate the effect of the S.E.S. on the predictive ability of intelligence tests within the individual socio-economic Groups. There seemed to be no cases where the increases approached significance. It was felt that the inclusion of the S.E.S. might contribute differently for the three different socio-economic Groups. The lack of any

significant increase may be the result of the reduced range since we are working within smaller Groups of the whole Sample.

In spite of the limitations of the study, it would be safe to consider the S.E.S. as a useful supplement, particularly for culture-reduced ability tests, when predicting future performance on achievement tests by pupils from a socio-economically heterogeneous population.

In summary we have obtained two major findings that were either not anticipated at all or were contrary to the theoretical framework upon which the hypotheses were based. Probably the more outstanding one is the low level with which we can predict the achievement of low socio-economic students by the use of some of the present standardized intelligence and achievement tests. Such minimal prediction coefficients make it difficult to determine whether the addition, to previous predictors, of any tests, let alone culture-reduced ones, would increase prediction significantly for the Lower socio-economic Group. It is suggested that this finding should be kept in mind when considering the other outcomes of this study.

The other finding, this one contrary to the theoretical framework, showed that the conventional ability tests were better (in some cases significantly) predictors of Grade 9 achievement, for the whole Grade 6-7 Sample over a three-year period, than were the achievement tests. Some of the conclusions of this finding have been made and implications for future research are mentioned in subsequent sections.

Implications

Theoretical. Under the existing circumstances in the Edmonton schools, the experimental findings did not fully agree with the theory behind the first hypothesis and behind the second part of Hypothesis 2. The culture-reduced tests helped predict the Upper Group more than the Lower Group. Certain assumptions can be made about the reason for the findings not supporting Hypothesis 1. It appears that with the type of treatment present in our schools, the nature of the criterion is one of the decisive factors in determining the type of measuring device that will be an effective predictor of future achievement. The inability of any of the tests used, whether culture-reduced or conventional, to predict the lower socio-economic status pupils effectively may also have bearing on the lack of support for Hypothesis 1 by the findings in the study. If we are to continue to use the Grade 9 Departmental tests as a measure of success at that level, and if there are no radically different ability tests developed to be used as predictors, then we must examine carefully the present treatment during the prediction interval and perhaps modify it to facilitate more accurate prediction of the lower socio-economic status students with at least some of the predictors that are available.

The results from this experiment did, however, uphold the theories upon which the other hypotheses were based. From this longitudinal investigation we have acquired certain knowledge regarding effective prediction procedures as well as appropriate devices for estimating Grade 9 achievement over six, three, and

two-year periods in school systems similar to the Edmonton system with pupils from homes which cover almost the full range of socio-economic status levels.

Practical. It is expected that the findings from this study can be applied in various school situations especially if the educational system is similar to the one which existed through this longitudinal investigation. To a certain extent, school personnel will be able to select tests which would give a more accurate estimate of the student's school performance in later years. This would ultimately enable the educators to suggest more realistic courses or patterns for junior high school students.

Some of the applications might be:

1. Studies show that culture-reduced ability tests measure lower socio-economic students more accurately. However, for prediction, under present treatment and for criteria such as Grade 9 Total, Social Studies, and Literature-Language it may be more advisable to use conventional tests with the lower, as well as with the upper, socio-economic students.
2. In predicting achievement such as Grade 9 Mathematics culture-reduced ability tests could be used since they have a tendency to give a better estimate of future achievement for all socio-economic levels than conventional ability tests.
3. Achievement tests should be used cautiously when trying to estimate future performance on achievement tests. The educators should make certain that the predictor achievement

test is not too "narrow" and not too far removed in time from the performance that is being predicted.

4. The trend for the low socio-economic status children to get progressively poorer in school achievement while passing from Grade 3 to Grade 9 would suggest that the school environment, or the environment of our society in general, probably does not really provide for the full intellectual development, especially in the verbal area, of these children. The school should examine its method of classification and treatment of the students during the school year and try to make optimum provision for members of the low socio-economic status level, particularly those with adequate potential ability, to develop their intellectual capacity to the fullest.
5. The school personnel should consider using the socio-economic status level of students as one of the predictors for obtaining more accurate estimates of future performance of these pupils in school.

Implications for Further Research

The investigation has established that the achievement of pupils from low socio-economic levels under the present treatment could not be predicted very accurately with either conventional or culture-reduced ability tests or standardized achievement tests. Studies could be undertaken to discover whether the tests presently available are just not appropriate for this socio-economic status level or whether some other influences reduce the ability to predict achievement for these pupils.

The results in this study have also suggested that under the present treatment the nature of the criterion might be as significant a factor as the socio-economic status level of the pupils in determining the type of predictor tests that should be used. For this study treatment has not been one of the controllable variables. The writer feels that if the treatment variable could be scientifically controlled the uncertainty of the findings in this area would be eliminated. More intensive research with more rigorous tests would be in order to study the interrelationships between the types of predictors, the types of criteria, and the type of people measured with respect to socio-economic status level, under varying treatments during the prediction interval.

Experiments using a variety of achievement tests as predictors as well as prediction intervals of different lengths would verify and clarify the findings in this study that stated that, over a three-year period, the conventional ability tests are better predictors of future achievement than are specific achievement tests. The present study also pointed out that the S.E.S. contributed significantly to the predictability of achievement for the full range of socio-economic levels but did not contribute towards prediction for the three individual socio-economic Groups. It might be useful to investigate in detail the effect of such scores for specific socio-economic levels.

B I B L I O G R A P H Y

BIBLIOGRAPHY

Altus, G. T. "Relationship of the WISC Scores to Group Test Measures of Intelligence and Reading", Am. Psychol., 7: 532, September, 1952.

Altus, G. T. "Some Correlates of the Davis-Eells Tests", J. Consult. Psychol., 20: 227-232, No. 3, 1956.

Anastasi, A. Differential Psychology. New York: MacMillan, 1958.

Anastasi, A. Psychological Testing. (2nd Edition), New York: MacMillan Co., 1961.

Barber, B. Social Stratification. New York: Harcourt Brace, 1957.

Bayley, N. "On the Growth of Intelligence", Am. Psychol., 10: 805-818, 1955.

Bayley, N. Proceedings, 1956 Invitational Conference on Testing Problems. Princeton: E.T.S., 1957.

Binet, A. and T. Simon. The Development of Intelligence in Children. Translated by E. S. Kite. Baltimore: Williams and Wilkins, 1916.

Blishen, B. R. "The Construction and Use of an Occupational Class Scale", Can. J. Econ., 24: 519-531, 1958.

Bryan, G. E. "Sex as a Variable in Intelligence Test Performance", J. Ed. Psychol., 48: 273-278, 1957.

Burke, H. R. "Raven's Progressive Matrices: Review and Critical Evaluation", J. Genet. Psychol., 93: 199-228, 1958.

Buros, O. K. (Editor) Fourth Mental Measurements Yearbook. Highland Park, New Jersey: Gryphon Press, 1953.

Buros, O. K. (Editor) Fifth Mental Measurements Yearbook. Highland Park, New Jersey: Gryphon Press, 1959.

Burt, C. Mental and Scholastic Tests. London: King and Son, 1922.

Burt, C. "Evidence for the Concept of Intelligence", Brit. J. Ed. Psychol., 25: 158-177, 1955.

Burt, C. "Class Differences in General Intelligence", Brit. J. Stat. Psychol., b, 12: 15-33, 1959.

California Achievement Tests: Primary. Los Angeles: California Test Bureau, 1951.

California Achievement Tests: Junior High Level. Los Angeles: California Test Bureau, 1957.

California Short-Form Test of Mental Maturity: Primary. Los Angeles: California Test Bureau, 1953.

California Short-Form Test of Mental Maturity: Elementary. Los Angeles: California Test Bureau, 1953.

Cattell, R. B. "A Culture-Free Intelligence Test", J. Ed. Psychol., 31: 161-180, 1940.

Cattell, R. B. "The Measurement of Adult Intelligence", Psychol. Bul., 40: 153-193, 1943.

Cattell, R. B. Handbook for the Culture-Free Intelligence Test. Scale 2. Champaign, Illinois; I.P.A.T., 1958.

Centers, R. The Psychology of Social Classes. Princeton: Princeton University Press, 1949.

Clark, J. H. "An Investigation of Certain Relationships Between the California Test of Mental Maturity and the Wechsler-Bellevue Intelligence Scale", J. Gen. Psychol., 41: 21-25, July, 1949.

Cooper, J. G. "Predicting School Achievement for Bilingual Pupils", J. Ed. Psychol., 49: 31-36, No. 1, 1958.

Cronbach, L. J. and G. Gleser. Psychological Tests and Personnel Decisions. University of Illinois Press, Urbana, 1957.

Cronbach, L. J. Essentials of Psychological Testing. New York: Harper Brothers, 1960.

Davis, A. and K. Eells. Davis-Eells Test of General Intelligence or Problem Solving Ability. New York: World Book Company, 1953.

Dingman, H. F. "The Relation Between Coefficients of Correlation and Difficulty Factors", Brit. J. Stat. Psychol., XI: 13-17, Part I, May, 1958.

Edwards, A. M. Comparative Occupational Statistics for the United States. 1870-1940. Washington: Government Printing Office, 1943.

Eells, K., A. Davis, R. J. Havighurst, V. E. Herrick, and R. W. Tyler. Intelligence and Cultural Differences. Chicago: University of Chicago Press, 1951.

Elley, W. B. "A Comparative Analysis of Socio-Economic Bias in Selected Intelligence Tests". Unpublished Ph.D. Thesis, University of Alberta, 1961.

Elley, W. B. and R. S. MacArthur. "The Standard Progressive Matrices as a Culture-Reduced Measure of General Intellectual Ability", Alta. J. Ed. Res., VIII: 54-65, No. 1, 1962.

Ferguson, G. A. "On Learning and Human Ability", Can. J. Psychol., 8: 95-112, 1954.

Ferguson, G. A. Statistical Analysis in Psychology and Education. Toronto: McGraw Hill Book Co., Inc., 1959.

Flesch, R. "A New Readability Yardstick", J. Ap. Psychol., 32: 221-233, 1948.

Fowler, W. L. A Comparative Analysis of Pupil Performance on Conventional and Culture-Controlled Tests. Ph.D. Dissertation, Ann Arbour, Michigan, 1955.

Freeman, G. L. Theory and Practice of Psychological Testing. New York: Holt, 1955.

Garrett, H. E. "A Developmental Theory of Intelligence", Am. Psychol., 1: 372-378, 1946.

Garrett, H. E. Statistics in Psychology and Education. Toronto: Longmans, Green and Co., 1959.

Good, W. R. "Misconceptions about Intelligence Testing", The University of Michigan School of Education Bulletin, May, 1954.

Gough, H. "A Short Social Status Inventory", J. Ed. Psychol., 40: 52-56, 1949.

Guilford, J. P. Fundamental Statistics in Psychology and Education. Third Edit. Toronto: McGraw-Hill Book Co., Inc., 1956.

Guilford, J. P. "Three Faces of Intellect", Am. Psychol., 14: 469-479, 1959.

Haggard, E. A. "Social Status and Intelligence: An Experimental Study of Certain Cultural Determinants of Measured Intelligence", Gen. Psychol. Monog., 49: 141-186, 1954.

Halsey, A. H. "Genetics, Social Structure, and Intelligence", Brit. J. Sociol., 9: 15-28, 1958.

Hatt, P. K. "Jobs and Occupations: A Popular Evaluation". Article in R. Bendix and S. M. Lipset (Editors). Class Status and Power. Glencoe, Illinois: Free Press, 1953.

Havighurst, R. J. and L. L. Janke. "Relation Between Ability and Social Status in a Mid-Western Community: III", J. Ed. Psychol., 35: 357-368, 1944.

Hebb, D. O. A Textbook of Psychology. Philadelphia: W. B. Saunders Co., 1958.

Hofstaetter, P. R. "The Changing Composition of 'Intelligence': A Study in T-Technique", J. Genet. Psychol., 85: 159-164, 1954.

Jacobs, J. N. "Aptitudes and Achievement Measures in Predicting High School Academic Success", Personnel & Guid. J., 37: 334-341, January, 1959.

Klineberg, O. Social Psychology. New York: Holt, 1954.

Knief, L. M. and J. B. Stroud. "Intercorrelations Among Various Intelligence, Achievement, and Social Class Scores", J. Ed. Psychol., 50: 117-120, No. 3, 1959.

Laycock, S. R. Manual of Directions: Laycock Mental Ability Test. Saskatoon: University of Saskatchewan Bookstore, 1935.

Loevinger, J. "Intelligence as Related to Socio-Economic Factors". Article in Intelligence: its Nature and Nurture. N.S.S.E. Yearbook, Part 1, 1940.

Lorge, I. and R. L. Thorndike. Lorge-Thorndike Intelligence Test. Boston: Houghton Mifflin Co., 1957.

MacArthur, R. S. "Assessing General Intellectual Ability for Adaptive Teaching Decisions", Paper presented to Annual Meeting of the Canadian Psychological Association, June, 1961.

Marquart, D. I. and L. L. Bailey. "An Evaluation of the Culture-Free Test of Intelligence", J. Genet. Psychol., 86: 353-358, 1955.

Martin, A. and J. E. Weichers. "Raven's Coloured Progressive Matrices and the Wechsler Intelligence Scale for Children", J. Consult. Psychol., 18: 143-144, 1954.

McCandless, B. R. Children and Adolescents. New York: Holt, Rinehart and Winston, 1962.

Moore, W. E. Industrial Relations and the Social Order. New York: MacMillan, 1947.

Neff, W. S. "Socio-Economic Status and Intelligence: A Critical Survey", Psychol. Bul., 35: 727-757, 1938.

Nolan, E. G. "Reading Difficulties vs. Low Mentality", Calif. J. Sec. Ed., 17: 34-39, Jan., 1942.

Piaget, J. The Psychology of Intelligence. London: Routledge and Kegan Paul, 1950.

Raven, J. C. Guide to the Standard Progressive Matrices. London: Lewis and Co., 1958.

Raven, J. C. Guide to Using the Coloured Progressive Matrices. London: Lewis and Co. Ltd., 1960.

Reid, T. J. and G. R. Conquest. "A Survey of the Language Achievement of Alberta School Children", Alta. J. Ed. Res., 1: 39-52, 1955.

Scannell, D. D. "Prediction of College Success from Elementary and Secondary School Performance", J. Ed. Psychol., 51: 130-134, No. 3, 1960.

Sheldon, W. D. and G. Manolakes. "A Comparison of the S-B Revised Form L and the CTMM (S-Form)", J. Ed. Psychol., 45: 499-504, December, 1954.

Skeels, H. M. and E. A. Fillmore. "Mental Development of Children from Underprivileged Homes", J. Genet. Psychol., 50: 427-439, 1937.

Spearman, C. E. The Nature of Intelligence and the Principles of Cognition. London: MacMillan and Co., 1923.

Spearman, C. E. and L. W. Jones. Human Ability. London: MacMillan and Co., 1950.

Strang, R. "Relationships between Certain Aspects of Intelligence and Certain Aspects of Reading", Ed. & Psychol. M., 3: 355-360, Winter, 1943.

Super, D. E. The Psychology of Careers. New York: Harper and Brothers, 1957.

Terman, L. M. "Intelligence and Its Measurement", J. Ed. Psychol., 12: 127-133, 1921.

Thompson, W. R. "Early Environment -- Its Importance to Later Behavior", in J. H. Hoch and J. Zubin, Psychopathology of Childhood, New York: Grune and Stratton, 1954.

Thomson, G. H. The Factorial Analysis of Human Ability. London: University of London Press, 1951.

Thurston, L. L. Multiple Factor Analysis. Chicago: University of Chicago Press, 1947.

Vernon, P. E. The Structure of Human Abilities. London: Methuen and Co., 1950.

Vernon, P. E. "A New Lood at Intelligence Testing", Ed. Res., 1: 1, 3-12, 1958.

Vernon, P. E. "The Classification of Abilities", Ed. Res., II: 184-193, 1960.

Vernon, P. E. The Structure of Human Abilities. 2nd Edit. London: Methuen and Co., Ltd., 1961.

Warner, W. L., M. Meeker, and K. Eells. Social Class in America: A Manual of Procedure for the Measurement of Social Status. Chicago: S.R.A., 1949.

Watson, R. I. Psychology of the Child. New York: John Wiley and Sons Inc., 1961.

Wechsler, D. The Measurement and Appraisal of Adult Intelligence. Baltimore: Williams and Wilkins, 1958.

West, L. W. "Assessing Intellectual Ability with a Minimum of Cultural Bias for Two Samples of Metis and Indian Children". Unpublished Master's Thesis, University of Alberta, 1962.

A P P E N D I X

APPENDIX A

CODE FOR VARIABLES IN TABLES XXV, XXVI, XXVII, AND XXVIII

Code for Variables in Tables XXV and XXVI

1. California Test of Mental Maturity - Language - Primary Short Form 1953 (Grade 3)
2. California Test of Mental Maturity - Non-Language - Primary Short Form 1953 (Grade 3)
3. Raven's Coloured Progressive Matrices (Grade 3)
4. California Achievement Battery - Total Reading - Primary 1951 (Grade 3)
5. California Achievement Battery - Total Arithmetic - Primary 1951 (Grade 3)
6. California Achievement Battery - Total Language - Primary 1951 (Grade 3)
7. California Achievement Battery - Total Test - Primary 1951 (Grade 3)
8. Department of Education Examinations - Literature-Language Total (Grade 9)
9. Department of Education Examinations - Social Studies (Grade 9)
10. Department of Education Examinations - Mathematics (Grade 9)
11. Department of Education Examinations - Science (Grade 9)
12. Department of Education Examinations - Grade 9 Total (Grade 9)
13. Socio-Economic Score (SES) (Grade 7)

Code for Variables in Tables XXVII and XXVIII

1. California Test of Mental Maturity - Language - Elementary Short Form 1957 (Grade 6)
2. California Test of Mental Maturity - Non-Language - Elementary Short Form1957 (Grade 6)
3. Laycock Mental Ability Test (Grade 6)
4. California Achievement Battery - Total Reading - Junior High 1957 (Grade 6)
5. California Achievement Battery - Total Arithmetic - Junior High 1957 (Grade 6)
6. California Achievement Battery - Total Language - Junior High 1957 (Grade 6)
7. Raven's Standard Progressive Matrices (Grade 7)
8. I.P.A.T. Cattell Test of g - Scale 2 - Form A (Grade 7)
9. Lorge-Thorndike - Figure Classification - Level 4 - Form A (Grade 7)
10. Lorge-Thorndike - Number Series - Level 4 - Form A (Grade 7)
11. Lorge-Thorndike - Figure Analogies - Level 4 - Form A (Grade 7)
12. Lorge-Thorndike - Total Non-Verbal Battery - Level 4 - Form A (Grade 7)
13. California Test of Mental Maturity - Language - Elementary Short Form 1957 (Grade 7)
14. California Test of Mental Maturity - Non-Language - Elementary Short Form 1957 (Grade 7)
15. Holzinger-Crowder Uni-Factor Test - Spatial Test 3 - Form AM (Grade 7)
16. Holzinger-Crowder Uni-Factor Test - Reasoning Test 7 - Mixed Series - Form AM (Grade 7)
17. Holzinger-Crowder Uni-Factor Test - Reasoning Test 8 - Figure Changes - Form AM (Grade 7)
18. Department of Education Examinations - Literature-Language Total (Grade 9)
19. Department of Education Examinations - Social Studies (Grade 9)
20. Department of Education Examinations - Mathematics (Grade 9)
21. Department of Education Examinations - Science (Grade 9)
22. Department of Education Examinations - Grade 9 Total (Grade 9)
23. Socio-Economic Score (SES) (Grade 7)

TABLE XXV

INTERCORRELATION COEFFICIENTS AMONG THE THIRTEEN VARIABLES FOR THE TOTAL GRADE 3 SAMPLE (N = 207) AND FOR THE UPPER SOCIO-ECONOMIC GROUP (N = 69) OF THE GRADE 3 SAMPLE

	1	2	3	4	5	6	7	8	9	10	11	12	13
1		425	285	139	219	034	123	229	430	201	396	365	154
2	339		430	123	251	168	259	203	145	159	216	183	141
3	432	414		-004	344	591	222	177	274	315	390	286	145
4	252	180	244		444	416	714	415	335	129	190	238	099
5	418	332	391	515		387	812	501	507	354	387	474	096
6	213	133	222	550	420		758	603	366	310	295	399	116
7	349	277	373	814	809	775		642	503	356	409	507	104
8	303	162	202	419	486	484	564		678	539	427	623	298
9	403	158	268	361	449	291	454	702		659	546	566	299
10	299	214	350	282	422	320	427	561	653		648	567	115
11	304	180	306	289	361	236	378	521	685	682		889	100
12	339	144	273	361	446	380	494	769	758	683	861		082
13	260	096	115	106	139	055	127	277	291	191	182	207	

Total Grade 3 Sample (N = 207)

Upper Socio-Economic Group of the Gr. 3 Sample (N = 69)

TABLE XXVI

INTERCORRELATION COEFFICIENTS AMONG THE THIRTEEN VARIABLES FOR THE MIDDLE SOCIO-ECONOMIC GROUP (N = 69) AND THE LOWER SOCIO-ECONOMIC GROUP (N = 69) OF THE GRADE 3 SAMPLE

Gr. 3 Sample (N = 69)	1	2	3	4	5	6	7	8	9	10	11	12	13	Gr. 3 Sample (N = 69)
1		305	326	391	451	320	486	251	359	290	215	213	162	
2	290		394	259	370	090	329	068	233	274	124	047	179	
3	632	409		401	387	231	442	187	216	307	165	164	073	
4	180	149	262		558	530	817	537	460	352	341	429	110	
5	513	371	433	513		435	857	441	337	354	219	296	125	
6	308	137	342	650	437		747	383	269	291	148	283	-009	
7	356	248	421	859	762	816		560	435	434	311	419	107	
8	286	209	204	306	477	498	501		675	621	607	802	033	
9	328	068	298	255	473	255	407	691		638	755	791	007	
10	314	186	408	311	533	353	463	481	631		683	729	119	
11	215	179	347	316	477	255	412	486	742	693		877	-003	
12	349	196	364	381	568	467	558	859	894	725	784		005	
13	027	-006	-015	-014	-057	-081	002	-070	110	-097	023	-040		

Middle Socio-Economic Group of the

Lower Socio-Economic Group of the

TABLE XXVII

INTERCORRELATION COEFFICIENTS AMONG THE TWENTY-THREE VARIABLES FOR THE TOTAL GRADE 6-7 SAMPLE (N = 237) AND FOR THE UPPER SOCIO-ECONOMIC GROUP (N = 79) OF THE GRADE 6-7 SAMPLE

	Upper Socio-Economic Group of Grade 6-7 Sample (N = 79)																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1		282	625	758	551	607	348	228	140	209	281	271	737	305	-012	303	254	667	571	353	378	517	099
2	340		372	342	490	375	505	242	311	392	399	465	413	463	205	354	334	234	233	349	324	259	-080
3	712	424		612	570	528	434	389	333	494	438	536	682	508	033	470	404	582	490	377	508	601	281
4	749	344	658		610	619	478	288	177	278	372	362	738	416	057	326	382	730	618	410	381	535	178
5	507	422	499	552		581	587	294	301	402	396	461	628	565	174	417	391	586	579	477	396	460	301
6	616	356	604	661	562		352	210	155	236	299	304	591	306	024	482	282	710	403	325	315	482	146
7	391	468	441	412	397	350		388	509	491	572	658	481	532	361	423	560	422	427	545	432	429	264
8	371	410	449	359	344	281	545		251	307	411	423	379	367	019	240	333	379	322	405	318	331	231
9	320	417	425	276	389	305	387	359		370	519	753	217	264	189	310	465	204	103	263	088	133	302
10	266	322	389	332	458	269	409	368	368		479	750	303	593	286	632	377	369	178	455	332	363	152
11	406	395	497	425	396	340	524	424	430	381		876	339	521	238	430	368	433	298	421	314	323	290
12	446	452	566	488	487	404	549	486	660	653	859		375	581	289	570	489	437	264	485	330	358	319
13	776	406	719	724	525	577	447	462	365	385	423	490		464	-147	348	393	638	591	425	398	502	164
14	360	513	419	340	429	348	530	476	404	460	504	552	428		287	514	414	370	451	506	402	382	221
15	224	291	214	154	115	085	406	275	245	301	298	332	169	309		255	272	-012	-015	226	261	183	-049
16	391	350	423	385	479	432	311	319	339	508	367	495	413	452	204		432	364	239	353	314	388	181
17	419	376	442	410	382	375	502	420	360	393	413	488	460	401	343	446		329	314	418	292	283	243
18	490	149	498	514	421	583	215	280	204	268	286	352	500	246	-042	366	257		675	501	435	662	316
19	452	211	452	538	433	370	266	326	175	243	304	313	529	291	059	330	314	694		636	578	599	285
20	359	295	366	412	387	315	375	396	260	375	342	396	407	424	201	370	408	539	633		676	571	176
21	386	271	421	364	326	251	327	373	202	301	301	325	451	332	270	333	330	510	689	700		880	126
22	496	242	534	518	409	443	312	358	219	308	313	366	534	315	142	381	325	773	772	691	861		138
23	327	067	311	316	169	220	183	230	121	166	227	250	361	130	099	270	239	366	364	245	247	301	

Total Grade 6-7 Sample (N = 237)

TABLE XXVIII

INTERCORRELATION COEFFICIENTS AMONG TWENTY-THREE VARIABLES FOR THE MIDDLE SOCIO-ECONOMIC GROUP (N = 79) AND THE LOWER SOCIO-ECONOMIC GROUP (N = 79) OF THE GRADE 6-7 SAMPLE

	Lower Socio-Economic Group of Grade 6-7 Sample (N = 79)																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1		471	693	737	462	633	388	319	324	228	393	441	787	327	384	410	473	324	346	221	231	357	129
2	391		498	344	457	230	510	490	491	287	425	435	409	472	437	278	403	-027	193	126	137	129	119
3	727	389		609	418	498	398	337	455	362	513	572	662	324	373	374	437	267	361	209	243	335	-021
4	676	313	653		409	628	400	271	288	224	413	500	675	243	237	319	262	275	419	238	229	349	169
5	509	345	499	639		454	494	376	401	487	326	417	468	410	262	400	323	202	289	295	203	247	118
6	562	371	684	682	610		341	178	212	161	331	350	512	314	224	299	353	334	200	178	071	215	117
7	377	402	441	334	204	319		644	421	411	449	488	422	515	405	250	480	016	216	286	247	187	042
8	484	539	554	426	356	378	622		378	365	332	421	416	525	466	313	468	-006	238	265	297	280	-061
9	407	419	438	277	432	479	259	441		381	377	555	397	394	266	317	340	022	178	206	250	161	-179
10	268	262	251	430	457	346	328	404	319		251	530	398	308	293	334	294	143	215	296	249	222	-007
11	422	335	465	388	471	334	565	526	394	433		835	338	473	264	241	468	116	203	195	199	174	-013
12	488	440	517	476	588	493	527	603	712	712	860		420	446	275	344	501	188	228	228	218	235	-067
13	719	381	723	670	514	564	408	517	398	375	488	557		348	428	397	430	276	429	244	326	404	035
14	403	611	414	341	343	386	539	549	514	509	513	659	465		360	366	397	044	198	351	295	196	-077
15	211	218	185	080	-031	005	426	358	229	318	340	385	108	276		231	430	-002	218	158	313	174	084
16	327	425	299	398	595	431	246	340	386	553	436	583	363	476	150		408	241	238	250	246	243	064
17	407	359	384	466	422	416	461	402	238	351	308	382	433	363	285	441		018	101	241	151	115	-104
18	350	190	495	437	458	615	173	327	353	211	268	358	440	297	-158	306	283		597	475	510	750	084
19	295	171	350	476	424	371	141	310	174	227	344	339	434	200	052	310	424	686		588	730	789	068
20	357	372	377	461	374	329	295	440	267	321	373	422	406	398	176	419	475	544	619		684	680	087
21	407	314	387	342	358	242	275	433	192	242	324	338	492	254	205	322	458	471	707	694		867	-078
22	471	301	547	550	503	521	284	446	312	252	385	423	557	339	020	371	474	855	879	777	796		039
23	097	-135	004	-067	-064	-073	102	044	-092	017	084	017	100	-028	107	-023	047	-028	064	-058	079	011	

Middle Socio-Economic Group of Grade 6-7 Sample (N = 79)

APPENDIX B

SOCIO-ECONOMIC INDEX

1. Name: _____ _____
(Last Name) (First Name)

2. Father's Occupation: _____
(Be clear. For example: Sales clerk at Eaton's, door-to-door salesman for Fuller-Brush, travelling salesman for Massey-Ferguson)

3. Mother's Occupation: _____

4. Do you ever use a language other than English in your home? _____
If you do, (a) Name it here: _____
(b) Circle the words which tell how often you use it:
Hardly Ever Quite Often Most of the Time

5. About how long have you lived in Canada? _____

DIRECTIONS: In the following questions, mark your answer by putting a circle in the right place. For example, in the question "Does your family have a car?" draw a circle around the "Yes" if your family does have a car, and around the "No" if it does not. Be sure to answer all the questions.

1. Does your family own a car? - Yes No
2. Does your family have a garage or carport? - - - - - - - - - - - - - - - - Yes No
3. Did your father go to high school? - - - - - - - - - - - - - - - - - - - Yes No
4. Did your mother go to high school? - - - - - - - - - - - - - - - - - - - Yes No
5. Did your father go to university? - Yes No
6. Did your mother go to university? - Yes No
7. Is there a writing desk in your home? - - - - - - - - - - - - - - - - - - Yes No
8. Does your family have a Hi-Fi or record player? - - - - - - - - - - - - - Yes No
9. Does your family have a piano? - Yes No
10. Does your family get a daily newspaper? - - - - - - - - - - - - - - - - - Yes No
11. Do you have your own room at home? - - - - - - - - - - - - - - - - - - - Yes No
12. Does your family own its home? - Yes No
13. Is there an encyclopedia in your home? - - - - - - - - - - - - - - - - - Yes No
14. Does your family have more than 100 hard-cover books? - - - - - - - - - Yes No
(4 shelves about 3 feet long)
15. Did your parents borrow any books from the library in the last year? - - Yes No
16. Does your family leave town each year for a holiday? - - - - - - - - - - Yes No
17. Do you belong to any club where you have to pay fees? - - - - - - - - - Yes No
18. Does your mother belong to any clubs or organizations such as study, church, art, or social clubs? - Yes No
19. Does your father belong to any such clubs or organizations? - - - - - - Yes No
20. Have you ever had lessons in music, dancing, art, swimming, etc., outside of school? - Yes No